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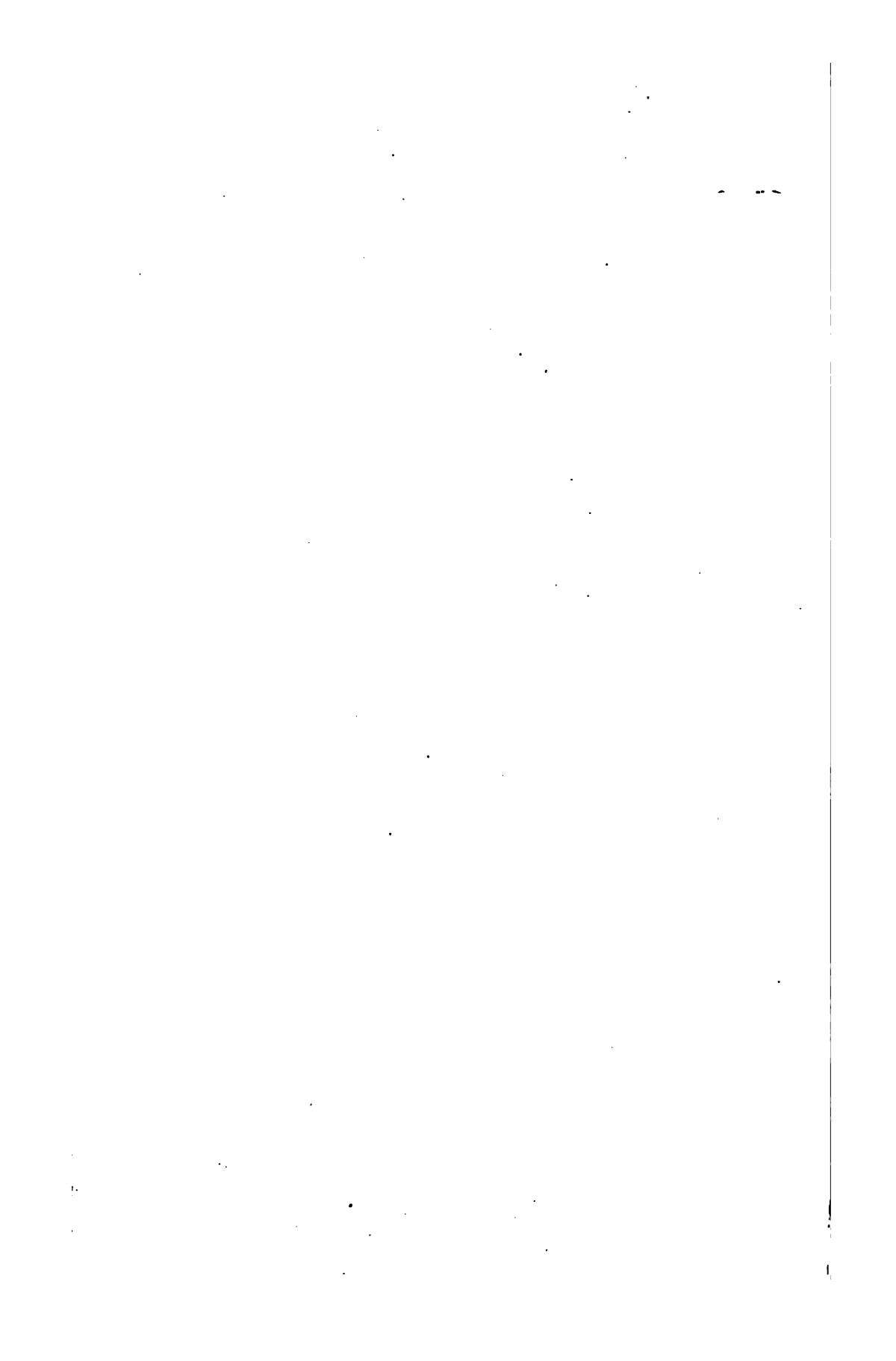
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Education Department Bulletin

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NO. 428

ALBANY, N. Y.

AUGUST 1, 1908

New York State Museum

JOHN M. CLARKE, Director

Museum bulletin 121

FOURTH REPORT OF THE DIRECTOR

N. Y. State Education Dept.
OF THE SCIENCE DIVISION

INCLUDING THE

61ST REPORT OF THE STATE MUSEUM, THE 27TH REPORT OF
THE STATE GEOLOGIST, AND THE REPORT OF
THE STATE PALEONTOLOGIST FOR 1907.

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ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1908

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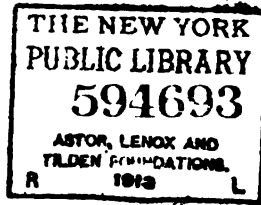
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New York State Education Department
Science Division, January 22, 1908

Hon. Andrew S. Draper LL.D.
Commissioner of Education

SIR: I have the honor to submit herewith my Fourth Annual Report as Director of the Science Division, for publication as the introductory portion of the 61st Annual Report of the State Museum.

Very respectfully
JOHN M. CLARKE
Director

State of New York
Education Department
COMMISSIONER'S ROOM

Approved for publication this 22d day of January 1908

Commissioner of Education

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THE STATE GEOLOGIST, AND THE REPORT OF THE
STATE PALEONTOLOGIST FOR 1907

REPORT OF THE DIRECTOR 1907

INTRODUCTION

This report covers all departments of scientific work under the charge of the Education Department and the Regents of the University and concerns the progress made therein during the fiscal year 1906-7. It constitutes the 61st annual report on the State Museum and is introductory to all the scientific memoirs, bulletins and other publications issued from this office during the year mentioned.

Under the action of the Regents of the University (April 26, 1904) the work of the Science Division is "under the immediate supervision of the Commissioner of Education," and the advisory committee of the Board of Regents of the University having the affairs of this division in charge are the Honorables: T. Guilford Smith LL.D., Buffalo; Daniel Beach LL.D., Watkins; Lucian L. Shedden LL.B., Plattsburg.

The subjects to be presented in this report are considered under the following chapters:

- I Condition of the scientific collections
- II Report on the Geological Survey, including the work of the State Geologist and Paleontologist, of the Mineralogist and that in Industrial Geology.
- III Report of the State Botanist
- IV Report of the State Entomologist
- V Report on the Zoology section
- VI Report on the Archeology section
- VII A State Historical Museum
- VIII Publications of the year
- IX Staff of the Science Division and State Museum
- X Accessions to the collections
- XI Appendix: New entries on the general locality record of the paleontological collections
- XII Appendixes (to be continued in subsequent volumes). All the scientific publications of the year.

I

CONDITION OF THE SCIENTIFIC COLLECTIONS CONSTITUTING THE STATE MUSEUM

The collections of the State Museum, both those exposed for exhibition and the much larger quantity, under stress of circumstances now in storage, remain in essentially the same condition as reported last year. With the present straightened quarters additional display of material, however interesting and instructive, is effectively debarred and as a consequence none of the recent acquisitions in which the past year has been fruitful have been made accessible to the public. The members of the scientific staff are industrious in the acquirement of materials. These materials are in very **large degree the basis of investigations** and must be temporarily accessible for study. Eventually, however, (and that is, generally, as soon as possible) these scientific specimens, irrespective of the interest attaching to them, or of their excellence, must be packed away in storage to await their resurrection in more adequate quarters.

The distribution of the various collections was stated specifically in the report of last year. It remains unchanged. The materials of the museum now occupy parts of

- A* Geological Hall
- B* State Hall
- C* Capitol
- D* Storage house, Orange street
- E* Flint Granite Co., Cemetery Station
- F* Property of Joseph L. Verstrepen, Delaware street

The offices of the members of the staff are also divided, part in the State Hall, another part in the Geological Hall.

The State Museum is a divided house, but not a house divided against itself. It stands, and there is every reason to believe that its work fortifies it by an uninterrupted progress along lines that are not alone of immediate practical import to the commercial interests of the State, but, of far greater ultimate moment to the community, also to a more adequate conception of the works and processes of nature. In the world's history never has the fact been made clearer than now that the State which most encourages scientific investigations for the purpose alone of determining the relation of its citizenship to the active natural forces on which that citizenship depends is performing its highest duty to the community and insuring its own stability. Though every channel of scientific knowledge seems gorged with details of information which few can digest, yet out of this choked and tangled mass, gradually unravel the guiding lines of knowledge which must give direction to the future progress of the race.

The new museum. In view of the dismembered condition of the State collections and the widely separated divisions of the working force, the advent of new and adequate quarters is hailed as the opening of an era which can not fail to infuse a wholesome spirit and a more definite objective in the labors of this organization.

In the 70 years of its history the scientific departments have had no direct appeal to the people save through the avenue of publication. It has been at no time possible to adequately display the tangible evidence of the State's natural resources. The real educational value of the collections is still untried though not unproven.

The provision made for museum quarters in the new Education Building on the basis of plans which have now been approved by the commission in charge thereof, will be not only adequate for present needs; it is hoped that provision has been made therein

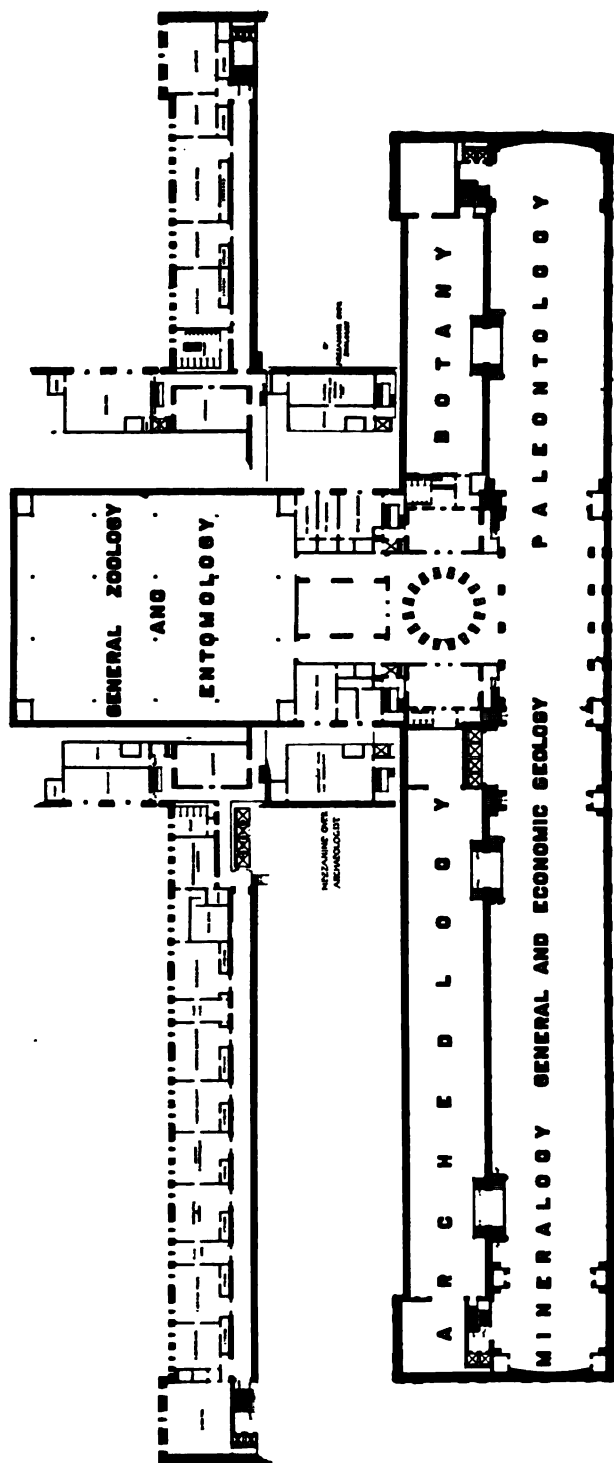
for the progress of another generation. Care has been taken to provide for such emergencies as time may bring and, while it is quite possible that the natural growth of the institution will uncover demands which have not yet presented themselves, experience has taught such vivid lessons in the economy of space that it is altogether likely we shall be equipped for such conditions.

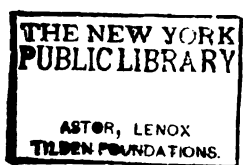
The accompanying plan indicates the general arrangement of space allotted to the Science Division, exhibition rooms and offices. The most notable feature in this arrangement is the great hall extending the full length of the front, 580 feet, with a width of 54 feet. This noteworthy room covering fully 30,000 square feet of floor space is broken only by architectural features extending at intervals partly outward from the walls, sufficient to divide the magnitude of the space into sections adequately adapted to the diversity of the proposed collections without interrupting the vista through the entire space. It is proposed to assign this space to the collections in structural and industrial geology, mineralogy, stratigraphy and paleontology, thus bringing together collections which in this museum have been treated as homogeneous. This fine chamber presents a problem in the treatment for the purposes for which it is designed, as its great length and height will tend to dwarf its contents unless these are displayed with studied care and with all possible assistance from approved and adequate appliances. From the central architectural feature of the chamber, the inclosed dome, corridors leading on either side into the north wing, open into a large room 131 x 106 feet affording a floor space of 13,886 square feet. This room is not divided except so far as the series of columns affords a basis for partition into communicating sections, should the materials to be installed require such treatment.

It is the present plan to reserve this large apartment to the collections in zoology, both vertebrate and invertebrate, inclusive of the extensive collections in economic and faunal entomology. To the right and left of the corridors leading to the wing are the offices of the Zoologist, equipped with room for necessary clerical force with dry and wet laboratories adjoining, and of the Archeologist. All the rooms thus described and apportioned are on the same level but over the last two chambers mentioned are mezzanines which afford space for storage of zoological material, maceration and plaster casting.

The architectural necessity of introducing trusses on the third floor of the building, crossing the inner subdivision of the main

Plate 1





or Washington avenue structure has resulted in an apparently very advantageous division of the museum floor into two levels. Thus from the main level described one rises by short flights of steps 5 feet to a higher platform running the entire length of the building on the inner side save where the space is divided by the dome and the corridors into the northern wing. This subdivision affords two long and somewhat narrow but not constrained chambers, one covering about 11,000 square feet, the other 5760 square feet. These rooms have excellent possibilities for the display of the extensive collections of the relics of Iroquois and other Indian cultures on one side, and for the botanical collections on the other.

The space thus available for exhibition purposes is

Hall of Geology.....	30 000	square feet
Hall of Zoology.....	13 886	"
Hall of Archeology	11 000	"
Hall of Botany.....	5 760	"
Total	60 646	"

All this exhibition space is lighted entirely from above; side light is wholly excluded. It is recognized that this mode of illumination will present its own problems in the effective disposition of the exhibits and may call for special construction or adaptations in the form of the cases in order to avoid puzzling or troublesome reflections, but it may prove to have especial advantages in flooding the whole chambers with light from one direction without the interruption or isolation that comes from light entering separate apertures, like a series of windows.

The construction which necessitates the elevation of the inner portion of the main floor also makes provision for a lower level on this inner side of the museum apartments. By a descent of 7 feet the lower level is reached and here, on either side of the main corridor to the wing, are rooms for the offices of the scientific and clerical staff adequately equipped with files, storage and laboratories. This lower floor turns the corner at each angle with the wing and runs beneath the offices of the Archeologist and Zoologist on the level above, providing room for an Insectory on one side and Artists rooms with north light on the other. This entire series of offices is supplied with lateral light and the suites have their own private corridors. The surface area of these offices is about 19,000 square feet. The total available space for all museum purposes is practically 80,000 square feet.

II

REPORT ON THE GEOLOGICAL SURVEY INCLUDING
THE WORK OF THE STATE GEOLOGIST AND
PALEONTOLOGIST, OF THE MINERALOGIST
AND THAT IN INDUSTRIAL GEOLOGY

GEOLOGICAL SURVEY

Areal rock geology

In continuation of operations directed toward the execution of a geological map on the topographic base of 1 mile to the inch progress has been made along lines which have been pursued for several years.

Central and western New York. Since my last report the double map including the Rochester and Ontario Beach quadrangles, embracing the city of Rochester and its environs, has been issued. This report was prepared by Mr Hartnagel. The Geneva-Ovid double north and south sheet and the Portage-Nunda double east and west sheet are printing. The latter contains special maps of Letchworth park at the Portage falls of the Genesee river and a chapter on the postglacial history of the river.

The Auburn-Genoa and the Honeoye-Wayland quadrangles have been completed as separate double maps, while the map of Phelps remains as a single quadrangle. Work has also begun on the Caledonia quadrangle and some preliminary observations made on the Belfast sheet. All this work has been executed by D. D. Luther. Of other quadrangles awaiting publication are the Syracuse sheet by Prof. T. C. Hopkins and the Morrisville sheet by H. O. Whitnall. The field work for the Cazenovia sheet has also been completed and that on the Chittenango sheet begun by Mr Whitnall.

All the quadrangles above referred to cover areas of sedimentary rocks only and the problems arising thereupon are almost exclusively those of refinement of stratigraphy and correlation.

Field work on the Remsen quadrangle has been completed by Prof. W. J. Miller. The northern half of this quadrangle is occupied by crystalline rocks and the rest by the Paleozoic sedimentaries. The crystallines include (a) highly altered Grenville sediments, (b) syenite gneiss, (c) a complex made up chiefly of intermingled Grenville rocks and syenite. The Paleozoic rocks comprise the Trenton series of limestones and the Utica shale.

Northern New York. Since my last report the Long Lake map and accompanying report by Prof. H. P. Cushing have been issued.

Professor Cushing's work in the past season has continued upon the Theresa and Alexandria quadrangles which also involve problems pertaining to both the crystalline and the sedimentary rocks. The mapping of the former was completed last season. In the work on the Paleozoic sediments which required the aid of a paleontologist, Dr Ruedemann assisted with the cooperation by invitation of Mr E. O. Ulrich of the United States Geological Survey. Mr Ulrich's intimate acquaintance with rocks of similar age in other parts of the country rendered his collaboration of much value.

During the previous season the Potsdam sandstone had been studied and was found everywhere to grade upward into a dolomite formation quite like the rocks which elsewhere immediately overlie the Potsdam around the Adirondacks and which have been regarded and mapped as passage beds into the Beekmantown formation above. It was naturally expected that the Beekmantown formation would be present here, to be followed in proper succession by the Lowville, Black River and Trenton limestones. In working downward from the Trenton as the summit rock of the quadrangle, the Black River limestone appeared with a thickness of some 20 feet and with a sharp lithologic boundary separating it from the Lowville beneath.

The upper part of the Lowville proves to be abundantly fossiliferous, but when followed downward these fossiliferous limestones are succeeded by others which carry an abundant ostracode fauna but with little else. These two limestones have a combined thickness of some 75 feet. Just beneath them follows a considerable thickness of whitish, very impure limestones, sometimes shaly, alternating with occasional beds of pure limestone and of dolomitic limestone with again an ostracode fauna. This mass has a thickness of about 80 feet and beneath it lies a 10 foot mass of pure blackish limestone with many fossils, mainly gastropods but with some cephalopods and trilobites. There is some mixture of Lowville forms in this fauna but in the main it consists of forms which do not pass up into that formation. The fauna appears to be one not before noted in New York, and according to Mr Ulrich seems comparable with the fauna of the upper Stones River formation of other regions. Its close association with the Lowville, both stratigraphically and paleontologically, seems to preclude its reference to the Beekmantown formation and its fauna is wholly different. The

name *Pamelia formation* is suggested by Professor Cushing for this series. The invasion of the sea during this stage was from the west, and this district marks the easternmost edge of its extent. Here alone in the State is the formation well exposed. A name for the New York expression of the series seems therefore called for. It overlapped an old land surface, thins rapidly eastward and thickens to the west, and its presence furnishes for the first time an adequate explanation of the great thickness of limestone reported by the drill in the deep wells of northwestern New York.

On reaching the base of the *Pamelia formation* it was found to rest everywhere on the beds which had been referred to as passage beds during the work of the previous season, and to rest on them with the most prominent unconformity noted among the sedimentaries in northern New York. The basal beds of the *Pamelia formation* are weak and therefore seldom exposed but when seen show everywhere a thin basal conglomerate and sandstone. The underlying formation had suffered considerable erosion as evinced by its varying thickness and the varying thickness of the beds of the *Pamelia formation* beneath the heavy fossiliferous limestone bed, as shown in numerous sections in small areas. The time interval in this unconformity seems to represent the whole, or the major part of Beekmantown and Chazy time. Nothing that can be correlated with the Beekmantown formation is represented in the section.

For the so called passage beds beneath, the name *Theresa formation* is proposed, their entire thickness being well exposed in the township of that name. This formation seems also to hold a fauna not before noted in the State.

The absence of the Beekmantown limestone, the great unconformity between the *Theresa* and *Pamelia* formations, and the close connection of the former with the Potsdam into which it grades, and of the latter with the Lowville, seems to add weight to the view previously urged, that the Potsdam-Beekmantown passage beds of northern New York, with possibly a portion of the Beekmantown, are so closely connected with the Potsdam that they must of necessity be classed with them, and that, since the normal fauna of the middle and upper Beekmantown is plainly a Lower Siluric fauna, the line of division between the two great rock groups is to be found somewhere within the limits of what has heretofore been considered as Beekmantown. In this connection the discovery of an unconformity between Brainerd and Seely's group A and group B of the Beekmantown, made by Messrs Ruedemann and Ulrich in the Ticonderoga region the past summer, comes to have large significance.

Both the Potsdam and the Theresa formations have large representation on the Alexandria quadrangle, but the chief interest attaches to the Precambrian rocks. The main rock of the Thousand Island region is a granite gneiss, a batholith of probable Laurentian age. Near its edges it holds abundant inclusions of schists, and passes by increase of these into a belt of schists cut by granite, these dikes diminishing as one recedes from the main granite mass. There is much in these schists to suggest that they are impure limestones transformed by the contact action of the granite gneiss. This Alexandria batholith seems to have been much richer in mineralizing agents than was the similar Antwerp batholith of the Theresa quadrangle. A coarse granite is also present which seems of later date.

Eastern Adirondacks. For a number of years, Prof. James F. Kemp, who has excellently served the State work in geology, has continued his investigations in the eastern Adirondacks. Under the auspices of the United States Geological Survey Professor Kemp has long devoted close attention to the intricate problems presented by the crystalline rock region of the Elizabethtown, Ausable, Mt Marcy and Lake Placid quadrangles. By an arrangement entered into with Professor Kemp, the Director of the United States Geological Survey and the Director of the New York State Survey, this work is now transferred to the supervision of this office with full assent to the eventual publication here of all the results acquired whenever the work shall have been completed. Under this understanding, Professor Kemp has reviewed and continued his work on these quadrangles. Some problems which seemed determined in the past have been of necessity reopened, for it was inevitable that there should be some gaps in the record and some former determinations requiring corroboration. During the past season Professor Kemp's work has been concentrated upon the Elizabethtown quadrangle, which is not only the most thickly settled of the four mentioned but economically the most important. Since the earlier fieldwork in this area was done, in 1896-97, we have come to recognize the great syenitic series of eruptive rocks which was imperfectly noted under other terms in earlier reports and thus made to accord with a scheme of classification at that time apparently satisfactory. This area, moreover, is on the border between the central anorthosite mass and the outer Grenville sedimentary and other gneisses. There are puzzling intermediate types and on the whole a complicated assemblage of rocks whose relations await determination. In the 10 years past there has also been extensive

development of mining and diamond drilling in the great iron ore bodies at Mineville and it has been desirable to bring the records up to date. There lies between the boundary of the Elizabethtown quadrangle and Lake Champlain a comparatively narrow belt of country in the Port Henry quadrangle which it has seemed desirable to treat together with the former, and as the latter includes areas of Paleozoic sedimentaries the assistance of Dr Ruedemann was enlisted in the solution of problems involved in the mapping of these. The season's work, thus, has been largely devoted to (1) reviewing and plotting new data in regard to the Mineville ores, (2) verifying and amplifying observations on the Elizabethtown quadrangle, (3) traversing the Precambrian formations of the Port Henry sheet. In general beneath the undoubted sediments of the Grenville and intimately involved with them along the borders there is a great series of rocks usually gneissoid but often massive, of a mineralogy ranging from the granites through the syenites to and into acidic diorites which are probably of intrusive origin and which represent one or more great batholiths. Though at times decidedly variable in composition this may well be due to the fusing into their substance of the Grenville sediments, which range from quartzites to limestones. The whole aggregate has been extensively faulted. Distinct from this complex are the anorthosites and some related gabbros, but between the anorthosites and the syenites there are intermediate transitions which add to the difficulty of sharply defined mapping.

Valcour island, Lake Champlain. Prof. George H. Hudson is finishing the survey of the eastern shore of Valcour island on the scale of 1:1000 and proposes to reduce the remainder of the island to one of 1:3000.

The chief reason for continuing the survey on this large scale is the fact that the region is one of curiously changing dip and strike. It has been influenced not only by east and west faults together with some compression, but the influence of a great and somewhat distributed north and south fault close to the east edge of the island is very apparent. The southwesterly section has been remeasured and some important corrections made, and the east section of the island worked out with good exactitude. This is the most important section of the island, because its beds present a hundred times the area of the south section.

An interesting result of this investigation is the recognition of the repetition of the coral and stromatoporeid reefs in the Chazy

Plate 2



Cliff on Valcour island, Lake Champlain, showing the undercutting by frozen spray on a weak stratum of thinly laminated limestones overlain by more compact beds

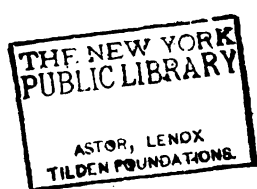


Plate 3



Reef dolomite (base of upper Chazy) Smugglers Harbor, Valcour island, Lake Champlain.

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Plate 4



Cystid point, Valcour island, Lake Champlain. The dipping upper Chazy beds at the left and the horizontal beds at the right indicate a syncline between

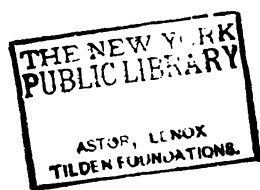


Plate 5



Paradise bay, northern arm, Valcour island, Lake Champlain Showing undercutting by freezing in joint planes and not by direct wave action

1

Plate 6



Another view at Paradise bay indicating the agency of frozen spray in undercutting the rock face

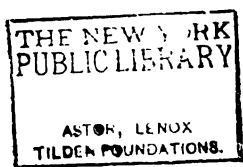


Plate 7



Glacial pebble from left bank of Saranac river about 1 mile above Plattsburg. Taken from the till close upon the glaciated bed rock. It shows a series of fine parallel striae made by sand grains lying between it and the bed rock and the usual irregular scratches and incisions caused by rubbing against other blocks in the till.

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TILDEN FOUNDATIONS

beds. Only one of these has commonly been recognized by other investigators. At Cystid point a reef is shown and its extinction and the deposit of sediment over it is clearly to be seen. Five meters down from this horizon and 300 meters to the north is another. Twenty-three meters down and 1000 meters to the north comes the more massive one which forms the "dove color" of Tiger point. Reef material is found again from 400 to 500 meters north of this and at a horizon 70 meters below the surface at Cystid point. This reef is as large as the Tiger point reef and in many respects resembles it. The shore is of a deeper blue dove color on the whole, yet this darker dove color may also be found in the Tiger point reef. The rock abounds in cephalopods and the trilobite *Glaphurus pustulosus*. The rocks of Sloop island (which show a pure dove colored rock as light as that of Tiger point) seem by their position to belong to this reef. One of the reefs noted belongs to the upper Chazy, the other 47 meters below it, is in the middle Chazy.

The fault system of the region is of interest and corrections have been made of the location of the faults mapped by others and also data on new faults acquired. A preliminary map of the intricate fault system of the Plattsburg region has been made and the fact brought forward that the form of Lake Champlain is the outward expression of some of the more extended of these faults. Enough evidence has been acquired to show the presence of two widely different systems and that correlation of the scattered observations is at least in part, possible. The north and south system appears to be the younger, or at least has suffered the most recent additions to its displacements.

A number of interesting observations have been made on the island, bearing on the glacial history of the region and on the striae of the glacial boulders. An enormous amount of the energy of a moving glacial sheet is spent in reducing its ground moraine to powder. The sheet of till in actual contact with the bed rock does not move so rapidly as the sheets lying over this. As a consequence comparatively few stones of the till are found with surfaces ground by contact with bed rock, for such a grinding produces a flat face with hundreds of parallel lines as may be seen in the adjoining photograph; on the contrary curved outlines predominate caused by contact with each other.

Highlands of the Hudson. Geological fieldwork in the Highlands was continued by Dr Charles P. Berkey during a part of the

season along the lines developed last year. Although less time than usual was available for this work, considerable additional area was mapped in both the West Point and Carmel quadrangles, some portions of which have been studied in detail.

In the discussion of *Structural and Stratigraphic Features of the Basal Gneisses of the Highlands* published last year in Museum Bulletin 107, the major structural types of the Highlands formations were outlined. As a related problem the chief reasons for doubting the exact equivalence of the Inwood limestone and Manhattan schist to the Wappinger limestone and Hudson River shales were given. A special effort has been made the past season to follow out all of the more promising lines of field evidence bearing upon this question of stratigraphic succession and correlation. This has led to the tracing of the contact lines of the tongues of crystalline limestones and schists that project into the Highlands from the south side. If these formations could be followed entirely through the Highlands to the north side, as the earlier maps indicate, it was believed that some direct relationship between these crystallines of the south side and the better known Cambrian strata of the northern border could be determined.

After studying for this special purpose all of the valleys that give such opportunities from the south, it seems necessary to conclude that there is no place in New York where the crystalline schists and limestones characteristic of the southerly areas can be traced through to the northern border. There is always a belt of several miles in width occupied only by the typical gneisses of the Highlands. This line of attack therefore furnishes no conclusive proof.

Observations made on numerous areas of the Cambrian strata of the northern border indicate a much more profound metamorphic change in them in passing eastward from the Hudson river to the Connecticut line. Limestones and schists, that seem to be beyond question equivalents of the Wappinger and Hudson River formations, have in that district all the characteristics of the Inwood limestone and Manhattan schist of the vicinity of New York city.

With such results in two of the lines of attack, it seems necessary to make a more minute study of the Stony Point-Peekskill region, the one district where apparently almost typical Cambrian formations occur on the southern border of the Highlands.

As the mapping of the ancient gneisses progresses it is evident that traces of interbedded limestones belonging to the oldest series of

the region are comparatively common. Several occurrences in addition to those previously enumerated have been mapped. Associated with two of these small limestone belts are graphitic schists of considerable prominence. These types are believed to lend further support to the sedimentary character of certain portions of the series. One of the graphitic outcrops has attracted some local attention looking toward development.

It is clear, however, that the proportion of the igneous members to the sediments in the basal gneiss series varies greatly in different areas. In the eastern part of the Carmel quadrangle those interpreted as igneous types greatly predominate. The prevalence of schists, limestones and quartzose rocks considered sedimentary, is much more marked in the West Point quadrangle and especially in the vicinity of the Hudson river.

Surficial geology

The problems relating to the impounding and drainage of surface waters upon the retreat of the glacial ice, the making and breaking of glacial and postglacial lakes, the molding of the present topography of the country to the change in the level of the marine waters and their former incursion into what are now fresh-water passages, have involved investigation along lines and in areas indicated in my report of last year, by Prof. J. B. Woodworth in the northeastern region, Prof. H. L. Fairchild in the central and western region and Prof. A. P. Brigham in the Mohawk valley.

For the northeastern region Professor Woodworth has practically completed the detailed mapping and report for the Schuylerville quadrangle. The report will give an account of the extensive sand deposits between Saratoga and Fort Edward which are not without economic interest because of the occurrence of molding sands in that district. The remarkable rock basins of Round lake and Saratoga lake are dealt with, but a final report on these features must await the detailed mapping of the topographic sheets in which their southern and western portions lie. These lake depressions notwithstanding their small size are of singular interest. The report will contain a diagnosis of late glacial lake and river changes, adding much in details to the preliminary sketch made in the report on *Ancient Water Levels of the Champlain and Hudson Valleys*. Similar work on the Rouse Point sheet lying directly east of the Mooers sheet already published has progressed and the completion of this map will carry the line of marine deposits from the base of

the Adirondacks along the International boundary to Lake Champlain. The customary classification of glacial deposits for the purpose of geologic mapping breaks down in this area by reason of the modification of the deposits through action of sea waves and currents. The problem of how best to map these modified glacial deposits has perhaps not yet been satisfactorily solved. The problem is a particularly difficult one by reason of the varying degree of alteration and rearrangement of the original accumulations. Some parts of the area display a typical glacial topography and underlying structure of the materials; yet other districts show the glacial deposits entirely recomposed in beaches, bars, and offshore sediments. These features are not always clear; there are large tracts in which no distinctive surface characters exist and in which the deposits can only be discriminated on such broad groupings as stratified, gravelly, sandy or clayey. This results in the necessity of coloring large areas as undifferentiated glacial and marine or glacio-marine gravels and sands.

On the Rouse Point quadrangle there is a marked belt of sandy beach deposits about the hills at levels between 180 and 220 feet above-sea level. Along the northern border of the area in the vicinity of Champlain village, pocket beaches occur at lower levels. Marine shells have been found in sufficient abundance to give some idea of the fauna. There is a noticeable abundance of *Mya arenaria* at these lower levels, but it is absent at the higher stands of the sea. Either this mollusk reached the area relatively late or lived only in the deeper offshore stations. Owing to its abundance in shallow surface deposits I am inclined to the view that it migrated into the Champlain area much later than *Saxicava rugosa* and *Macoma greenlandica*. If this be true it may be possible to differentiate locally these life zones. *Mytilus edulis* also appears in abundance and in an excellent state of preservation at these lower levels, as on the Isle la Motte.

The field work indicates pretty clearly that a moraine belt extends southeastward across the Mooers area towards Chazy, indicating a protrusion of the ice front into the Champlain embayment at a late stage, possibly as an ice advance after the sea once got into the area. Unless the unfossiliferous clays about East Beekmantown and near the lake shores in that vicinity and around Alburg can be referred to the lacustrine stage, no deposits are recognized which can be definitely referred to the glacial lake waters which preceded the marine invasion in this field, nor have any Prewisconsin drift deposits been found.

The shores of Lake Champlain about its northern end seem in places to be higher than when the cliffs were cut. The evidence from many parts of the shore is not conclusive for or against changes of level, either a rising or a sinking. Such channels as that from Champlain village suggest a rising of the water level. It is probable that the highly tilted Siluric slates in Vermont are being crowded up and that downward movements have been taking place among the faulted rocks of the New York shore along the International border.

Western, central and northwestern New York. As a result of Professor Fairchild's investigations the story of the succession of glacial waters in western, central and northern New York is approaching completion. Following several introductory and preliminary papers, the glacial waters held in the Lake Erie basin in this State have been described in State Museum bulletin 106. The later waters in central New York down to the Iroquois stage are described in the paper awaiting publication. Lake Iroquois is well known in its general character and history, but there yet remains for description: (1) the local glacial lakes held in the valleys of the western and northern Adirondacks during the Iroquois stage; (2) the extinction of Lake Iroquois; (3) the sea level waters which occupied the Ontario basin subsequent to Lake Iroquois and preceding the present Lake Ontario. The past summer's work has been on these three elements of the history, and is briefly summarized in the following description.

(1) *Local glacial lakes.* All the well defined valleys sloping westward or northward from the Adirondack mass must have held glacial waters while the ice acted as a barrier. The largest and most interesting of these local lakes was the one in the Black river valley, which in all the elements concerned in the functions and relationship of such waters is the most excellent known in the State. The larger part of the summer was used in the study of this lake, and its description will form the subject of a future paper.

(2) *Iroquois extinction.* A broad ridge of Potsdam sandstone extending north from the Adirondacks into Canada forms the divide between the Champlain and Ontario basins and is the critical area in this study. A rapid examination of the divide shows that the Iroquois waters were held up to the Rome outlet until the south edge of the ice body had receded as far north as the International boundary, but that here the waters found lower escape across Covey hill, the north end of the ridge. The outflow here cut the great

ravine locally known as the "Gulf" in the resistant Potsdam sandstone, and the seaward escape of the Ontario basin waters was shifted from the Mohawk-Hudson to the Champlain-St Lawrence. These waters, with level inferior to the Iroquois and with different outlet, require a distinctive name and it is proposed to call them Hypo-Iroquois.

With only a little further recession of the front of the ice sheet on the end or nose of Covey hill the Hypo-Iroquois waters found yet lower escape between the ice and the north-facing land slope, and the outflow carved the slope into a series of irregular benches or terraces. When the waters were lowered between three and four hundred feet below the intake of the Covey gulf the level of the ocean was reached and the waters in the Ontario basin blended with the sea.

The gravel bars of the Iroquois shore have been traced to a point midway between Watertown and Carthage, but eastward and north-eastward from here the shoreline is weak and very irregular, passing far up the valleys of the present north-flowing streams. The deltas built at the mouths of these rivers in the Iroquois waters are proofs of the relation of streams to the high-level lake, and they have interesting characters. Excepting the Potsdam quadrangle the long stretch of the Iroquois shore from Carthage to Covey hill is unmapped by the topographic survey and its close study is not at present advisable.

(3) *Gilbert gulf*. The marine beaches on the north slope of Covey hill are remarkable for their strength, number and composition. The upper ones are strong, close set ridges of sandstone boulders. Aneroid measure makes the highest continuous bar about 460 feet A. T. This is 10 feet higher than the figures previously given for the upper reach of the marine waters by Gilbert and Woodworth. It is particularly desirable to determine the precise altitudes for the several Covey hill features and the State should place benches along the International boundary.

Passing down the hill slope from the marine summit bar it is found that 20 distinct bars occur in a descent of only 140 feet, the greatest interval (aneroid measure) being 12 feet. This multiplication of the wave-built ridges agrees with the theoretical expectation, since the vertical spacing was produced by the very slow, and probably uniform, uplifting of the land out of the sea, giving opportunity and time for bar construction at all interior levels.

Professor Woodworth has traced the marine shore westward some distance and Professor Fairchild has located the upper limit

at points north of Burke and Malone. Topographic sheets of the region are necessary for the mapping.

The sea level waters in the Ontario basin, called Gilbert gulf have left definite shore features which had been mapped previous to this season as far north as the mouth of Stony creek, 3 miles southwest of Henderson. During the summer the mapping has been carried northeastward to Stone Mills, on the Theresa quadrangle.

The highest Gilbert gulf bars lie at about 262 feet altitude near Texas, northeast of Oswego, where the water plane passes beneath the level of Ontario. The plane rises to the north so that the highest bar is 325 feet at Henderson Harbor; 375 feet at Dexter; 380 to 390 feet at Stone Mills and Depauville; and about 400 feet at Clayton. Along the nearly north and south line of 46 miles between Texas and the Hogback hill, 4 miles southwest of Clayton the average rise is about 3 feet per mile. With the assistance of Mr F. A. Hinds of Watertown the altitude of the highest of the strong Iroquois bars on the Farr place, 3 miles east of Watertown, was determined by precise leveling as 733 feet, a reduction of 7 feet from the previous aneroid figures. Using this corrected altitude we find that the deformation of the Iroquois shore in the stretch between Richland and Farr's is $733-566 \div 30 \text{ miles} = 5.6$ feet per mile. It appears therefore, that the average uplift on the Iroquois shore in this region is nearly twice that of the marine beaches, which fact has an important bearing on the time relations of the two water bodies.

Before the details of the closing stages of the Preontarian waters can be advantageously studied and the dramatic history fully written, the topographic sheets of the areas northwest and north of the Adirondacks must be published. The sheets more specially needed for this study are the four along the State boundary lying between the published Mooers and Massena sheets; also the sheet east of the Carthage sheet.

Aside from these items of Pleistocene history in the regions referred to, a review has been made of contemporary features of the Upper Genesee valley with special reference to the relations of the preglacial drainage and glacial lakes of the river to the production of the gorge and cataracts at Portage.

The region under study by Professor Brigham includes the Broadalbin, Gloversville, Amsterdam and Fonda quadrangles, an area of about 900 square miles, reaching from the southern Adiron-

dack region into the edge of the Appalachian plateau south of the Mohawk river. It does not, however, include any uplands belonging to the Helderberg or Catskill regions, although these are near at hand and conspicuously viewed from the southern boundary of the area. The principal drainage of the area is through the Mohawk river, with several of its affluents, principally the Schoharie, while the Sacandaga controls the drainage of a part of the northern border. The northern limit is nearly marked by the village of Northville, while Duanesburg and Esperance villages are close to the southern border. On the west the area extends just beyond the Big Nose or west of Yosts Station.

Glacial lobes. Perhaps the most salient features brought out by the investigation of the territory are two glacial lobes, one a part of the great Mohawk glacier, which is now demonstrated to have moved westwardly for a short distance up the Mohawk valley and what may be called a *Sacandaga glacier*, moving southerly about the region of Northville, swinging toward the southwest in the neighborhood of Mayfield, filling into affluent westward flow with the Mohawk glacier about Gloversville. The existence of such a westward Mohawk flow was postulated by Chamberlin on the evidence which was at hand many years ago. Further advent of this westward movement has been given by Professor Brigham.

Conspicuous evidence of this movement is found in the glacial striae which are well distributed throughout nearly the entire area. About 60 localities of such striae have been found and recorded. The direction is not on the average greatly variant from westward, but north and south of the Mohawk river in the neighborhood of the Big Nose there are interesting divergences. On the north of the river to the west-northwest and on the south of the river toward the west-southwest, illustrating the axiradiant flow of Chamberlin, a still more interesting and somewhat puzzling divergence is found in the neighborhood of Galway village west and northward where some of the striae point distinctly toward the northwest and even branch toward the north-northwest. As the glacier apparently came around into the Mohawk valley from the Hudson-Champlain depression, this seems a curious condition. What possible effects, if any, of local glaciation in the Berkshires and Catskills may have produced results here, remain to be determined. It may be asked whether this postulated western flow might not have been a flow to the eastward as the striae themselves do not ordinarily give special evidence as to whether the flow was in one direction or the other,

but the carriage of erratic material and the relative distribution of the drift in certain localities, leave the westward flow beyond question. A still more striking confirmation is found in connection with the Schoharie valley. On the east side of the lower Schoharie within this district, the drift is a very massive till and outcrops of the bed rock are almost absent. In fact that section of the Schoharie valley from Esperance to Fort Hunter was filled with till to a remarkable extent and the postglacial excavations by the stream have produced a singularly interesting series of topographic forms normal to river action. On the west of the Schoharie on the contrary, outcrops of the bed rock are everywhere present, the drift is very thin, ledges and glaciated benches are frequent and the region gives every evidence of having been powerfully scoured. These conditions as between east and west are exactly what would be expected from a westward moving glacier, passing over the hills in the neighborhood of Minaville, dumping and filling in the valley transverse to its course, and drifting powerfully against the edges of the exposed striae west of the stream, cleaning away the drift and giving to the whole topography a characteristic glacial expression. It should be remembered, however, that these striae and other evidences of a westward flow only determine the last glacial conditions of the area. What earlier flows there may have been and what their directions were, must for the present, and perhaps always, be left to conjecture.

As above indicated, the valleys drained by the Sacandaga distributaries permitted a considerable glacier to flow southward out of the mountain region and the striae, while not so numerous as in the Mohawk region, are sufficient in number and distributed in such a manner as to leave no doubt of the directions already described. Two localities of striae about 4 miles southeast of Batchellerville show gradings of a south-southwest direction, belonging evidently to this Sacandaga or southern Adirondack movement, which was quite at right angles to the northwestward movement already noted in the neighborhood of Galway.

Interlobate moraine. One of the most interesting glacial developments in the entire district is a belt of sand hills extending across the Gloversville and Broadalbin quadrangles from Gloversville westward over Cliff hill and eastward toward Broadalbin, Hagadorn's Mills and Barkersville. This grade moraine is in many parts massive, from 1 to 2 miles wide, hills sometimes low and spreading and other times lofty and massive, more often with constructional

moraine forms, sometimes toward the southern edge tending toward the drumlin form, as if that edge of the moraine had been overridden. No doubt some of the smaller present hills are of the nature of dunes as there are localities where the sand is still exposed to the free action of the winds. A considerable part of the city of Gloversville is situated on this moraine, and the more direct road from Gloversville to Broadalbin is about in the center of the moraine and traverses a region which has many of the characteristics of a desert. This grade moraine apparently was accumulated between the two lobes already described where the edges touched or approximated each other. As far as can be judged from limited observations and from the appearance of topographic maps, the moraine belt extends from Barkersville northeastward along the base of the mountains to Corinth. Its western extension if any, has not yet been traced.

Recessional moraines. South of the moraine already described, in the field of the Mohawk glacier, special moraine accumulations are almost absent excepting heavy deposits of till in the Mohawk valley which have been so reshaped as largely to lose their character as moraines. In any case they represent dumping and filling in the immediate Mohawk valley and the work of localized tongues. The region south of the river to the limit of the district is distinctly free of anything which could be called morainic. On the eastern edge of the district from the interlobate moraine southward to the Mohawk river a number of small morainic areas were found, generally of till. It is evident that these extend over in some measure into the Saratoga quadrangles eastward, and further study may develop a distinct belt of such moraine. In that case it would appear to mark the recession of the glacier out of the Mohawk valley to limit the western edge of the Hudson valley glacier at that stage of recession. This would be in harmony with Professor Woodworth's efforts at the determination of the existence of a Hudson valley glacier extending down toward Schenectady and thus preventing the accumulation of the sands of Lake Albany over the region northward from Schenectady. Various accumulations that may be called recessional are found in the Sacandaga region, especially in the neighborhood of Osborne's bridge and northward but more especially in the Sacandaga valley northward from Northville and northward from Edinburg. Here are two great accumulations of constructional hills of sand and gravel which may be regarded as the terminal of the Sacandaga glacier at that stage of its recession.

Distribution of the drift. Some facts have already been given in the description of the glacial lobes. No general estimates of the thickness of the drifts are offered. These it is believed are sure to be delusive. It may be said in a general way that in the Adirondack portion of the area the drift is apt to be thick in the valleys and it is generally thin on the slopes and summits as would be expected. In the Sacandaga basin south of Northville and over the region of the Great Vly the drift is of unknown thickness and outcrops are rare. Naturally the drift is very massive along the belt of the interlobate moraine, and south of this moraine extending from about West Perth eastward for 7 or 8 miles there is a broad flat topped plateau-like mass of till sometimes showing sandy phases. The north edge of this region is near Broadalbin and the south near Perth, the ridge averaging perhaps 3 to 4 miles in width. It is on the high ground between the Mohawk and Sacandaga basins and it is seen as a conspicuous profile from all high points south of the Mohawk river. It is historic in the sense of having carried the ancient highway of Johnstown to Saratoga. It is conjectured that it has been a great overridden moraine of an earlier age but this suggestion is offered doubtfully and with hesitation. South of this region toward the Mohawk river, especially in the region between Galway and Amsterdam the drift is thin. Around Johnstown eastward and westward it is comparatively massive. So is it also at many points in the Mohawk valley. South of the Mohawk it inclines to be thick near the river but averages thin wherever the glacier overrode the higher sandstones which lie south of the black shales. An exception, however, appears several miles about Charleston Four-corners where the geological map shows almost no outcrops and where the drift must be comparatively massive. An interesting belt of drumlins exists in the vicinity of Gloversville and Johnstown. At Johnstown these drumlins make up a large part of the territory, show altitudes of from 50 to 150 feet and are the most conspicuous elements in the topography. The same is true northward and north-westward of Gloversville to the base of the Adirondacks. A few of these drumlins are peculiarly massive and noble in proportion, making an aggregate of great ellipsoid swells which command the attention of the observer. The same forms are found eastward of Gloversville and along the road from Gloversville to Mayfield and curiously these forms in some cases emerge among the sands of the interlobate moraine. Some of these are seen between Gloversville and Broadalbin, the sands sweeping around the base of the drumlins and in some cases partly up on one side or one end. Many of the

drumlins are conspicuous for groups of large boulders turned on their eastern slopes. The axis of the drumlins is in a way east-west but within the field of the Sacandaga glacier some of them tend towards the northeast-southwest direction as do the drumlinoid forms about Mayfield. Thus the drumlins and drumlinoids fall into perfect harmony in direction of trend with the glacial striae. The till of many of these drumlins is comparatively light and sandy but this may be said also of the ground moraine in general in the vicinity of the crystalline rocks. Indeed the ground moraine everywhere in the region follows the usual law of glacial deposits in showing the close kinship to the bed rocks from which it has been so largely derived. This has a conspicuous bearing on the agriculture of the region and it will be found, for example, that the drift around Johnstown partakes especially of the character of the underlying black shales and the soils are consequently rich and the region agriculturally prosperous. A similar belt, productive for the same reason, is found south of the Mohawk river for a width of 4 or 5 miles in the vicinity of Scotch Church, Minaville and Glenville. On the higher sandstone hills the drift, as already indicated, is not only thin but partakes of the poverty of the sandstones so far as its productive capacity is concerned.

Lake deposits. Some of the most interesting accumulations of the district were made in standing water. These include small areas of high level sands, evidently in pools or lakelets sustained by retaining walls of ice. An example of this is found west of Hagadorn's Mills, a tablelike deposit which has been cut in two by the waters of the Kenneatta. Another of these level sand deposits likewise dissected by a stream, is found southwestward from Benedict and another conspicuous example lies just westward from Edinburg. In the eastern part of Gloversville is an area of flat or gentle sloping sands or clays which are doubtfully interpreted as deposits of a lake surrounded by a glacial moraine and waning glacial ice.

Deposits of Lake Sacandaga. This name is given to a body of water which evidently occupied the depression now known as the Great Vly. Its water was apparently held in place by the massive drift in the region of the interlobate moraine and by the receding ice of the Sacandaga in the direction of Batchellerville and Conklinville. The basal deposits of the Vly are undoubtedly sediments of this lake overlain by large accumulations of swamp and vegetable material. The most interesting and distinctly formed delta of the district was built by the issuing waters of the Sacandaga glacier

at and south of Northville. Most of Northville village lies upon a flat table which is a remnant of this delta. The delta can be traced for about a mile north of Northville heading against the great recessional moraine to which reference has already been made. South of Northville it has been largely dissected and much of it swept away by the Sacandaga river. Slight remnants are seen on the east of the river but the major parts of it are on the west. Beginning with the flat sandy area on which the resort known as Sacandaga Park is situated and extending southward to a point eastward from Cranberry creek and past Ogden's creek toward Northampton some small areas of till emerge from the silts of the delta near its edge and from Sacandaga Park to Osborne's bridge much of the old delta area is occupied by terraces and flat plains and old channels of the Sacandaga river.

Lake deposits of the Mohawk valley. These include conspicuous deposits of sand, silts, clay and gravel at altitudes varying from 440 to 460 feet, in some cases a little higher. These are found about the Lower Cayadutta and west of Fonda. They extend from Fultonville to the Schoharie creek south of the river. They are found conspicuously along the north side of the river and east and west of Tribes Hill. They also appear at the golf grounds of the Antlers Club and along the river on the north side of Amsterdam, and east and west around Port Jackson. These deposits are conspicuous and they are to be seen at Hoffmans Ferry. In the great delta on the north side there are minor exhibitions of them south-eastward to Rotterdam or a little beyond. These silts and sands evidently represent waters at an altitude of from 440 to 460 feet and the determination of a barrier by which such waters should be maintained has been one of the most puzzling questions of the investigation. No entirely satisfactory answer is at hand, but it is the best belief of the writer that the barrier was ice in the vicinity of Schenectady. It is not necessary to believe that the entire strip of the valley from Schenectady westward was in the earlier stage occupied by these waters continuously, for at some points in the vicinity of Amsterdam, for example, there are the accustomed clays containing scratched stones and there are sands and gravels of such irregular character as to lead to the conviction that the waters in which they were deposited were in the immediate presence of ice, which could have been no other than a local remnant ice tongue extending up the valley from the main glacier which still lingered in the region of the middle Hudson. These deposits at similar

levels are found to the westward of the area now under consideration, nearly or quite up to Little Falls. It seems very probable that the capacity of stagnant ice to maintain a barrier has been greatly underrated. Such ice is often covered with debris. The streams which would flow over it, proceeding from a recent glaciated region would naturally be so overloaded that they would tend to aggregate rather than to erode. No spillways or water-swept areas at the proper altitude have been found on the hill flats westward from Schenectady although some search has been made for them. The problem demands further study but the evidence is conclusive that lake waters in front of a waning ice tongue occupied a long section of the Mohawk valley at about the altitudes indicated.

There is some evidence that such conspicuous accumulations for example, as the great sand flat "west of Fonda" is not altogether and perhaps is not largely a delta of the Cayadutta creek, for on the very borders of the Mohawk river on the south edge of the lacustrine accumulation is found at least one locality cross-graveled, dipping to the northward, whereas, as further north and toward the head of the supposed delta, the deposits are silts and fine sands. This points to the suggestion that the deposited part at least was made while the immediate valley of the Mohawk was occupied by a remnant glacier from which these gravels were derived.

Deposits of Lake Albany age. The waters of Lake Albany extended up the Mohawk valley. The writer is not aware that this fact has been sufficiently recognized, but by consulting the contour maps of the valley it will be seen that the waters of Lake Albany at an altitude of 340 or more feet would extend far up the present course of the river. This also carries with it the interesting conclusion that the Iroquois drainage which swept down the Mohawk valley and is believed to have deposited as a delta the Schenectady and Albany sands, must have been a drainage following the belt of still water through a long stretch of the Mohawk valley. A number of deposits of coarse gravels have been identified in the area as probably belonging to the Lake Albany stage. It could not have any reference to the present or recent work of the river and they do not seem to belong to the earlier 440 to 460 foot stage already described. Such deposits of coarse gravels occur down at Yosts where they have been largely excavated by the New York Central Railroad. They form a stone ridge east of Randall, south of which ridge is an interesting old channel of the river waters. They occur again in the hill about 40 feet in height which extends

northeastward from Fort Hunter and they are found conspicuously developed as appears by the map, from Hoffmans Ferry toward Schenectady. Doubtless these deposits were much more extensive than they are at present, having been largely swept away by the waters of the river after Lake Albany subsided. Reference has been made to the heavy tills of the Mohawk valley. These are basal and massive on both sides of the river. At certain points as already described, they are capped by the lacustrine silts and sands of the higher level, but in many cases these sands, which must have sloped down to the flood plain level originally, and amassed tills, have been swept away along the lower slopes so that in cross-section we should have massive tills sloping from the upland down to the river. At certain points, as east of Fultonville and along all the lower parts of the city of Amsterdam, are belts of water-swept till. Along these lower grounds of the city of Amsterdam till is very thin, bed rock near at hand, and east of the city are fields of boulders which apparently are remnants of tills of which great Iroquois currents have removed finer materials. For many miles along the Mohawk river the deposits of the drift are exceedingly steep. They are almost cliffs and there is an entire absence of morainic contours. These forms could not have been constructional in the glacial sense. When these tills were dumped into the Mohawk valley they must have been purely morainic forms resulting from a melting down of the ice tongues which occupied the valley. It would seem that these slopes of till with their occasional covers of the customary silts have been powerfully undercut by Iroquois waters, giving the steep slopes of the present, but it must also be recognized that that undercutting could not effectively take place until there was some subsidence of Lake Albany waters allowing effective current action by the grade stream carrying the drainage of the glacial Great Lakes. These facts and suppositions involve a problem concerning the Iroquois drainage and the waters of Lake Albany which deserves further and more final investigation. An interesting remnant of the Lake Albany silts is found near South Schenectady along the waters of the Normans kill. Here, near the region of the Amsterdam quadrangle is a small embayment of Lake Albany waters and therefore a reentrant area of sands which joined with the greater area that appears in the Schenectady quadrangle.

Schoharie lake. An interesting development of lacustrine sands and clays is found along the Schoharie river from Esperance up stream for some miles. In looking for a cause of these lacustrine

accumulations it was discovered that by the dumping and filling process already described a great till barrier had been formed across the Schoharie valley just south of the small village of Burtonsville. That till barrier raised the waters of the Schoharie above that point to a height of about 100 feet greater than at present. The till has been cut away down leaving cliffs largely of till but also in part, on the concave side of the bend, cliffs of bed rock. It would appear that this raising of the waters must have extended about 20 miles up the Schoharie from Esperance and that the lake was maintained there in the immediate postglacial times until the barrier could be cut away. There is apparently a well marked delta belonging to this lake above Central Bridge and along the valley towards Cobleskill. The conditions of this lake above Schoharie village need further study for their full elucidation.

Areas of marsh and obstructed drainage. It was not practicable to distinguish in the mapping between areas of existing marsh and areas of soft meadow which represent recent or comparatively recent lake filling. These areas, however, serve in an interesting way to show the obstruction of drainage caused by glacial deposits and a moment's inspection of the map would show that where the deposits are conspicuously massive, as along the belt of interlobate moraine, the areas of marsh and lake fillings are conspicuous. It is quite possible that many small areas apparently due to recent lake filling, may have been areas also occupied by small lakes of glacial age. This, however, can not be determined unless there are chances for suitable excavation or exposure of the materials. Thus along Auries creek about 2 miles southwest of Glen is a flat ground about a mile in length which would naturally be taken as a combination of lake filling and flood plain but a chance section made by the stream shows massive lacustrine clays containing glacial stones and therefore demonstrably representing a lake of glacial age.

Summary. The field investigations for these four quadrangles, Broadalbin, Gloversville, Amsterdam and Fonda, are practically completed and seem to show conclusively the presence of the two great glacial lobes already described with a massive interlobate moraine with scant evidences of any recessional moraine in the case of the Mohawk glacier, but at least one conspicuous belt of recessional moraine in the case of the Sacandaga glacier. The retreat of the ice is marked by the presence of glacial waters, notably small high level sand plains of the Sacandaga delta, the high level lacus-

trine silts and sands of the Mohawk valley, the gravels and sands of the Lake Albany and Iroquois stage, and the lacustrine clays of Lake Schenectady. Postglacial modifications of the glacial deposits are conspicuous along the valleys of the Mohawk and the Schoharie. Curiously along the Mohawk there is nothing that can be called ordinarily alluvial terrace. Meanders are practically absent while along the Schoharie terraces meanders and abundant oxbow channels are typical and conspicuous. These differences point to radical differences in the history of the major valley as compared with that of its tributary, and these differences have to do, it would seem, with the marked lacustrine conditions and great lake outflow that belonged to the Mohawk valley. As already intimated the conclusions here announced by Professor Brigham and the hypothesis suggested need explanation and confirmation by close study of surrounding areas. It is desirable to know the westward and southern limits of the Mohawk lobe. From the general appearance of the topography it would seem that the powerful glaciation of the Mohawk region must have ceased not far south of the boundary of the present area. The map of the Berne quadrangle south of the Amsterdam quadrangle seems to show interesting conditions which it has not been possible to study in the field. Near the middle of the quadrangle there is a conspicuous bifurcation in the trends of the drumlinoid or linear forms of topography, indicating apparently a push to the west as a part of the flow of the Mohawk glacier already described, and a push to the south along the lines of the Hudson valley. It is conjectured that a study of this area in the field will show corresponding directions of the glacial striae and that here may perhaps be found a point of conspicuous divergence between the Mohawk and Hudson river lobes of the glacier at a certain stage of their activity.

Industrial geology

Mines and quarries. The third of the series of annual bulletins reviewing the progress of the mineral industries in the State was published in July of the current year. There is a steady demand for information relating to the mineral resources, such as is given in these publications, and the continuance of their issue seems advisable.

The statistics collected for publication in the report indicate a material growth in the importance of the mining and quarry industries during recent years. The total output of all materials re-

ported by the individual producers was valued in 1906 at \$37,118,430, the valuation being based on the crude or first marketable form of the products. The corresponding total for 1905 was \$35,470,987 and for 1904 it was \$28,812,595. The varied character of the industries is shown by the fact that there are some 35 different materials produced in commercial quantities. Among the more notable developments recorded in the last report are those relating to the iron ore, gypsum and salt industries, all of which have possibilities for expansion greatly beyond present proportions.

These mineral statistics are gathered and tabulated with ultimate care. It is believed that they present the most accurate analysis given to the public of the condition of mineral production in this State. They are published with promptitude and as early as possible after the close of the calendar year.

Iron ores. The description of the iron ore resources of the State has been an urgent need for some time. The previous reports of Emmons, Putnam and Smock are out of print and besides are wanting in many particulars to make them representative of present conditions in the technical and scientific branches of the subject. Field work preliminary to a new investigation was started in 1905 by the Assistant State Geologist and has been continued as opportunity offered during subsequent seasons. Owing to the size of the territory that has to be covered by field work it has been deemed advisable to issue a separate report on each of the larger districts, whereby an earlier publication of the results will be assured. The Adirondack magnetites will be described in the first report, the preparation of which is now practically completed. In this part of the work the cooperation of Prof. J. F. Kemp has been secured. He has kindly undertaken to prepare a description of the Mineville district which he has recently mapped in connection with the survey of the Adirondacks now being carried out under the direction of the State Geologist.

The investigation of the Adirondack magnetites has brought out much that is new concerning their geology. The important problems bearing upon the character of the rock associates and origin of the so called nontitaniferous magnetites have been studied with care, and while they are extremely puzzling, it is believed that progress has been made in their elucidation. The walls inclosing this class of ores belong to the feldspathic gneiss series which it has been found includes both igneous and sedimentary derivatives. There may be distinguished, thus, two main varieties under which all of the occurrences probably are included, though in a few cases

the evidence is insufficient at present to place the magnetites definitely with either. The igneous rocks which carry the ore belong to several types, ranging from acid granites on the one hand to granites poor in quartz, syenites and even more basic phases that approach the gabbro-anorthosite group which contains the titaniferous ores. It appears very probable that there is a close relation in the geological occurrence of both classes of ores found in the igneous rocks, since the latter show the most intimate connection in their fundamental characters. Like the titaniferous class, the low-titanium ores (they are not strictly nontitaniferous) are native to the wall rocks and have formed in their present place by some process incident to the cooling and consolidation of the latter. Magmatic segregation has perhaps been influential in some instances, as has already been pointed out by Cushing, but the mineral associations of most of the magnetites point to gaseous or gas-aqueous agencies as the more important factor in the process of formation. The ore bodies originated previous to the dynamic stresses which have affected the whole region and thus have been drawn out and aligned parallel to the general foliation. The magnetites found in the sedimentary gneisses differ from the others in several respects. They are always pyritic and have, as associated minerals, garnet, scapolite, sillimanite and usually much hornblende. Their origin is doubtful as the evidence bearing upon it is subject to different interpretations. They may be ancient beds interstratified with the wall rocks or later introductions due to ground waters or insulations set up by the igneous invasions. They are frequently cut by granitic masses and they are possibly an older series than the other magnetites.

The mining industry of the Adirondacks has grown considerably in the last two or three years. The outlook for its future seems quite promising. Not only are the low-titanium ores being developed on a larger scale than previously, but there is a good prospect that the titaniferous deposits will soon be worked on a commercial scale. The new enterprise at Lake Sanford, mentioned in the issue of this report for 1906, has been active during the current year in carrying on investigations; productive operations only await the construction of a railroad to the locality which is in a now inaccessible part of the Adirondacks.

In accordance with the recommendation made in my report of last year the Legislature granted a specific appropriation for the exploitation of the Clinton hematite ores of central New York. It was therein pointed out that a large body of these ores lies almost

wholly undeveloped along a belt of country more than 100 miles in length, east and west between Clinton and Wolcott, that it was of first importance to the iron industry in this State to determine probabilities of variation in the volume of this ore body in its dip and local variations in the quality of the ore.

To ascertain these facts borings are necessary at various points south of the observed or buried line of outcrop. The more numerous such borings are the more accurate the deductions will be. It would be well if series of such holes could be put down at points from half a mile to 2 miles back of the outcrop at alternating intervals of about 5 miles, but the present provision will not cover the cost of so much drilling. We are therefore now engaged in putting in with diamond core drill a single series of holes which will have an approximate average depth of 175 to 200 feet and which have thus far been located about 2 miles south of known surface outcrops. The outcome of this undertaking will have to be deferred to the next report.

Oil shales. An undeveloped source of eventual wealth to the State lies in its vast deposits of densely black, bituminous shales which reek with the components of natural gas and petroleum. These beds of black shale lie in the Devonian system of western and southwestern New York, particularly in the Genesee and Portage divisions of the Upper Devonian and are to be found in outcrop quite freely from Canandaigua lake westward to Lake Erie. Preliminary efforts have been made this year to ascertain the available hydrocarbon content of these shales for the purpose of instituting comparisons between them and similar shales like those of Scotland which are today distilled for the commercial production of petroleum, paraffin and ammonia sulfate. The method of treatment of the Scotch shales and the products resulting may be thus briefly stated. The oil is distilled at a temperature of about 900° F. The spent shale is then heated to about 1300° F. to increase the yield of ammonia and permanent gases from the shale. The Scotch shales yield on an average 25 gallons of *crude oil* and 45 pounds of *ammonia sulfate* per ton.

The first distillation of the crude oil yields:

- 1 *Green naphtha*. This is treated with sulfuric acid and caustic soda yielding "shale spirit" or naphtha.
- 2 *Still coke*; a valuable smokeless fuel, the production of which has now become an extensively capitalized industry.
- 3 *Green oil*; the source of paraffin.

The oil is tested with sulfuric acid and caustic soda and is then ready for the second distillation, by which it is fractionated into *light* and *heavy* oils, the latter containing solid paraffin. The light oils are used in making four grades of burning oils. The *paraffin* is obtained from the heavy oil by cooling below 32° F. and straining out by means of filter presses. The paraffin is then subjected to further treatment producing paraffin wax.

The value of the products of the Scotch shale industry is upward of £2,000,000 annually, and is rapidly increasing. The results derived from the analyses made of the New York shales are too incomplete to afford adequate basis of comparison as the method of distillation employed seems not that best adapted to the problem. The indicated proportions of fixed carbon and volatile hydrocarbons are apparently less than in the Scotch shales, but it is not certain that a more exact treatment with care to prevent volatilization of the hydrocarbons would not give a different result. At all events the results obtained are sufficiently encouraging to justify further pursuit of the inquiry.

SEISMOLOGICAL STATION

The seismological station of the State Museum has rendered efficient service throughout the year. Except for occasional stoppages of short duration — usually less than an hour each — due to the necessity of making readjustments from time to time, it has been operative continuously since March 10, 1906, when the instruments were first installed.

One of the chief objects of the records is to secure information relative to the character and frequency of earth tremors in the vicinity of Albany, which are set up by distant shocks. This line of investigation has never before been carried on anywhere within a radius of several hundred miles from the station. The results thus far obtained have shown the locality to be well adapted for receiving records and have already thrown considerable light on the subject. With the present equipment the larger earthquakes throughout the world are registered within a few minutes of their occurrence. It is hoped also that the observations may afford information as to possible earth movements of local nature. These have not been detected as yet, though it is considered more than probable that there are slow oscillations going on within the neighboring region which in the course of time will manifest cumulative effects of sensible magnitude. The observations must be continued

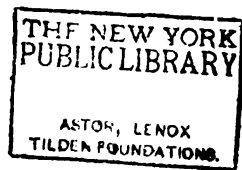
over a considerable period to form a basis for the study of these movements.

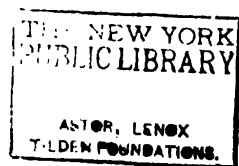
The importance of seismological investigations is rapidly gaining recognition in this country; stations are now planned or under installation at Cambridge, Mass., New Haven, Conn., and Ann Arbor, Mich., as part of the scientific equipment of the several universities at those places. In the near future there will thus be a series of stations covering the northeastern section of the country quite completely, as observations are now made also at Cheltenham and Baltimore, Md., and Washington, D. C. It may be suggested that the work might be materially advanced by coordination of the different observing points, and it is hoped that some arrangement of the kind will be effected. In this manner the detection of the small local movements which are apt to be confused with the feebler tremors of distant origin would be specially facilitated.

The Albany station has been called upon frequently to supply information regarding earthquake occurrences, both for the press and for scientific purposes. Records have been available some times long before the arrival of telegraphic dispatches from the centers of disturbance. It has also been possible to demonstrate the non-existence of many reported shocks in the neighboring region. The observations relating to the San Francisco and Valparaiso earthquakes have been supplied to the California Earthquake Commission and the International Seismological Association for use in the preparation of their reports.

The year just ended was the first for which a complete series of records has been obtained. In all, 19 disturbances, large and small, were registered. A tabulation of the data is given herewith, accompanied by notes explanatory of the individual occurrences. Similar information covering the period March 10 to October 1, 1906, was included in the report for that year.

The character of the records traced by the instruments differs in each case, and it is not possible to give all the elements for every disturbance. Some of the more remote shocks which are apparently of relatively small proportion cause only feeble vibrations indicated by a slightly wavy line as traced on the recording cylinder. The record of larger earthquakes, on the other hand, is usually resolvable into several portions of distinctive character from which deductions may be made, according to well known principles, as to the distance traveled by the waves, and the direction and relative magnitude of the disturbance.





A description of the instruments in use at the station has been given in a previous report. The important constants applicable to the interpretation of the records are as follows: Latitude, n. $42^{\circ} 6'$; longitude, w. $73^{\circ} 45' 18''$. Weight of each pendulum, including arm, 11.283 kilograms. Distance of center of gravity from rotating axis 84.6 centimeters. The period of the pendulum (time required for a complete swing) averages 30 seconds, with variations of two or three seconds from the mean. The recording arm has a multiplying ratio of 10. The base of the instruments is approximately 85 feet above sea level.

RECORD OF EARTHQUAKES AT ALBANY STATION OCTOBER 1, 1906 TO
OCTOBER 1, 1907

Standard Time

Date	Beginning preliminaries	Beginning principal part	Maximum	End	Max. ampli- tude
	h. m. p. m.	h. m.	h. m.	h. m.	mm
1906					
Oct. 1	9 28 p. m.	.. ..	.. ..	10 30	1
Nov. 14	1 34 p. m.	.. ..	.. ..	1 41	7
Dec. 3	5 03 p. m.	.. ..	.. ..	5 30	....
Dec. 22	1 39 p. m.	2 03	2 15	3 0	10
Dec. 23	12 39 p. m.	12 52	12 52	1 34	5
1907					
Jan. 2	7 53 a. m.	7 55	7 56	8 24	8
Jan. 4	12 43 a. m.	1 25	1 26	2 17	6
Jan. 14	3 47 p. m.	.. ..	.. ..	4 12	1.5
Mar. 31	5 16 p. m.	.. ..	.. ..	5 47	....
Apr. 15	1 14½ a. m.	1 19½	1 33	3 0	a
May 28	10 00 a. m.	.. ..	.. ..	.. ..	....
May 31	8 02 a. m.	.. ..	8 12	9 00	....
June 1	3 55 a. m.	.. ..	.. ..	4 38	....
June 4	10 31 p. m.	.. ..	.. ..	11 53	2
June 28	1 25 p. m.	.. ..	.. ..	2 12	....
July 1	8 14 a. m.	8 23	8 28½	9 15	50
Aug. 17	11 40 a. m.	.. ..	.. ..	12 15 p. m.	....
Sept. 2	11 12 a. m.	11 36½	11 38	3 00 p. m.	50
Sept. 23	4 46 p. m.	.. ..	.. ..	5 37	....

a Amplitude over 150mm maximum exceeding the limit of registry.

October 1. A slight movement lasting a little over an hour and registered only on the north-south pendulum, showing the direction to be nearly at right angles. The same disturbance was noticed at the stations at Washington, Isle of Wight and Perth, Australia. Its origin was not definitely fixed, so far as has been learned, but it was probably in the southern Pacific or Indian ocean.

November 14. A small disturbance, probably centered within 2000 miles of Albany. Slight shocks were reported in New Mexico and Kingston, Jamaica.

December 3. A series of minute vibrations producing a wavy line. Disturbance was of West Indian origin.

December 22. A very characteristic record of a macroseism. The east-west component was the larger with a maximum amplitude of 10 millimeters as compared with 6 millimeters for the north-south component. The duration of the preliminary tremors indicated a source from 6000 to 10,000 miles distant. A heavy earthquake was reported in Russian Turkestan in the vicinity of Lake Balkash at 11.20 p. m., and when due allowance is made for time difference and transmission of the waves, the relation between the record and this disturbance becomes apparent.

December 23. Registered mainly on the east-west machine, with an indicated distance of 4500 miles from Albany. A distinct occurrence from the preceding, perhaps originating in the Cordilleran region of Mexico or South America.

January 2. The same disturbance was recorded at Laibach, Austria, a little later than at Albany. Its center was somewhere in the Pacific.

January 4. A distant shock of unknown source.

January 14. The earthquake which destroyed Kingston and had its focus in the vicinity of that city. The record of the waves was scarcely proportional to the reported intensity of the shock, showing only vibrations of small compass without any distinct division into preliminary and main portions. The first waves to arrive were apparently the main ones, as the destructive shock occurred at 3.35 p. m., according to press dispatches, or 12 minutes before the beginning of the record. This would indicate a velocity of about 3 kilometers per second which is the average rate of travel of the larger waves.

March 31. Faint vibrations of undoubted seismic character. An earthquake was reported in Turkish Armenia on this date, but the accounts are so vague that no connection can be established certainly with the Albany tracing.

April 15. Remarkable for the magnitude and duration of the main tremors. The indicated intensity of the shock exceeds that of any recorded before or since by the seismograph. The two components have nearly the same amplitude in their principal parts, though the east-west machine shows a longer absolute period of disturbance, the north-south pendulum ceasing to vibrate at 2.20 a. m. The pointers of both pendulums swung completely off the cylinder. The earthquake seems to have been centered south of Mexico City

in a sparsely inhabited region, which accounts for the small damage and loss of life that ensued.

May 28. Slight trembling indicated on the north-south pendulum, continuing at intervals until 5 p. m.

May 31. Faint tremors of seismic nature.

June 1. Small disturbance, coincident with a slight shock in Ecuador.

June 4. A distant earthquake traced for over an hour on the north-south pendulum.

June 28. Small tremors.

July 1. This disturbance would seem to have been a severe one, and perhaps 5000 miles distant in a southerly direction. The Havana station reported its passage at 7.43 a. m. It was probably submarine.

August 17. A thickening of the line traced by the north-south instrument, breaking into minute waves 20 minutes after the beginning

September 2. A very distant shock, as shown by the long duration of the preliminary tremors and by the continuance of the record for an interval of nearly four hours. Vibrations much more pronounced on the north-south machine. The Isle of Wright station reported its passage later than American stations so that it undoubtedly came from the Pacific.

September 23. Vibrations of small amplitude throughout.

September 24. North-south pendulum showed a condition of slight instability, due to a small earthquake. Disturbance recorded at Washington.

MINERALOGY

In the section of mineralogy, the research work has included an investigation of the crystal forms of the calcite from Rossie, St Lawrence co., a study of the crystal forms and twinning habit of the new occurrence of calcite from Sterlingbush, Lewis co., and a study of the minerals from Newcomb, Essex co. The work on the Rossie calcite which yielded two forms new to the species and 12 which are new to the occurrence, has amply demonstrated the value of detailed crystallographic study on a large number of specimens from localities even as well known as this one. The work on the Newcomb minerals, which is still in progress, has already yielded a new form for arsenopyrite and three new forms for wernerite as well as a ratio for the axial elements of the latter mineral very close to that determined by vom Rath.¹ The tourmalin crystals

¹ Pogg. Ann. 1863. p. 119-254, 262.

from Newcomb have also proved of interest as showing rare crystal forms.

A case containing a few examples of the large and unique crystals from Sterlingbush has been installed in the corridor fourth floor of the Capitol where the fine pink and purple of these specimens show to excellent effect.

The packing for storage of the large collection of New York minerals was completed and a system of labeling for the boxes has been devised by which newly collected material can be sorted into its place when the entire collection is reassembled.

A collection illustrating the recent work of the museum in mineralogy was exhibited at the last annual reception of the New York Academy of Science at the American Museum of Natural History in December.

The mineral collections have been enriched through the gift of Mrs J. V. L. Pruyn of a collection illustrating the minerals from the vicinity of Mount Vesuvius, and by the gift of Mr H. H. Shaw of a large collection of minerals from Lyon Mountain, Dutchess co., N. Y., which latter amply supplements the material previously acquired by the museum from this interesting locality. A beautiful series of minerals from foreign localities was obtained from Dr F. Krantz of Bonn.

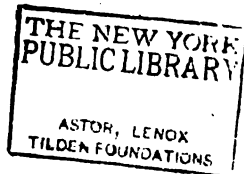
The field work of this section has resulted in the collection of a number of handsome specimens from the graphite mines in the vicinity of Crown Point and Ticonderoga, Essex co., of a series of over 50 specimens of tremolite from a new locality near Gouverneur, St Lawrence co., and of a large number of specimens of calcite for exhibition and study from the limestone quarries at Smith's Basin, Alsen and West Camp.

An important addition to the series of gem minerals from New York, comprises 26 crystals of diopside from the well known localities at DeKalb, St Lawrence co. These average 15 millimeters in diameter, the largest measuring 35 millimeters across the basal section. They are, for the most part, transparent and of a fine emerald green color. They were obtained by the Assistant State Geologist from Mr Calvin Mitchell of DeKalb Junction.

PALEONTOLOGY

Early Devonian faunas. In all of my recent reports reference has been made to the progress of investigations and correlation studies of the New York early Devonian faunas and those of the

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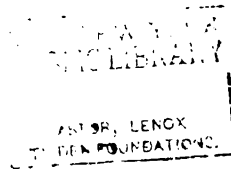
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St Lawrence gulf region. The work has progressed more slowly than could have been anticipated largely because of the great difficulties involved in executing the plates in accordance with the accepted standard of our lithography. The first volume of this memoir covering especially the geology and paleontology of the Gaspé region of Canada has stood complete in type for a year awaiting the production of these plates. The illustrative matter is now finished and it will be possible to distribute this part of the work within a short time. Meanwhile the second part has gone to press. This second volume is concerned with these faunas in their development in New Brunswick and Maine and particularly recounts the aspects and character of the faunas in New York. During the past year a very significant addition to the Oriskany faunas in this State has been made by the discovery in Orange county along the eastern limb of the Skunkemunk mountain syncline of a considerable development of this horizon in which the preservation of the fossils is instructive and the species full of interest, as many have been seen for the first time, others mark the first appearance in this State of forms recorded from more eastern localities.

When Professor Hall was elaborating the paleontology of the Helderberg and Oriskany formations the development of these rocks in the Appalachian region of New York south of the Helderberg mountains did not contribute materially to his stores. The outcrops in this region had been delineated with approximate accuracy by Mather but in all his paleontological work in New York, Hall seldom got far away from the undisturbed rocks of the central and western districts of the State to which he was early wedded. Work was later done in this Appalachian region by N. H. Darton of the United States Geological Survey (which can not be regarded as making any advance in accuracy upon that done 50 years before by Lieutenant Mather) and by Dr Heinrich Ries, who constructed a map and report of Orange county recording interesting data in regard to details of stratigraphy without attempting close analyses on the basis of paleontology. In the instructive but involved sections entangled in Appalachian folding the arenaceous deposits of the Lower Devonian have generally passed as "Oriskany" and the calcareous beds beneath as "Lower Helderberg," a discrimination which is no longer accurate or adequate. In late years the regions have been given careful study at certain points and the succession of the faunas closely analyzed. Perhaps the first of these efforts was that made by the writer to portray the character of the Oriskany

fauna of Becraft mountain, the sole outlier of this stage on the east of the Hudson river. This was followed in the year 1903 by two important contributions, one by Stuart Weller on the Paleozoic rocks and faunas of New Jersey, in which he discussed the sections at the entrance of the western or Port Jervis-Otisville branch of the divided Paleozoics of eastern New York and those further south in his own state; another by Gilbert van Ingen and P. E. Clark on the "Disturbed Rocks in the Vicinity of Rondout, N. Y." [Mus. Bul. 69] in which all the precise determinations were made by Mr van Ingen.

In 1905 Prof. H. W. Shimer published the paleontology of the section at Port Jervis known as Trilobite mountain [Upper Siluric and Lower Devonian Faunas of Trilobite Mountain, Orange County, N. Y., Mus. Bul. 80].

Prof. George H. Chadwick has recently brought together some results of further examinations made for the State Museum, of the sections at Rondout and southward into Greene county, with the special aim of elucidating the composition of the Port Ewen fauna. Though these results have not been put in final form the author's determinations are of very considerable interest.

The Port Ewen beds, to rehearse briefly the history of this stratigraphic unit, are a series of thin limestones and gray lime shales, which, in the Appalachian region of New York and New Jersey lie immediately below the Oriskany silicious limestone and upon the Becraft limestone, bear the lithic character of the New Scotland lime shales and carry a large percentage of Helderberg fossils. It is a division not recognized by the early geologists in their partition of the "Lower Helderberg" and it is entirely absent from the succession west of Schoharie. Its earliest recognition as a definite unit was by Prof. W. M. Davis in 1882 who termed these rocks whose position he determined as above the Becraft limestone, the "Upper shaly beds" contrasting them in this designation with the "Catskill or Delthyris shaly limestone" below. Professor Davis did not attempt to delimit these beds and did actually, according to Professor Chadwick, include in his division some part of the "Upper Pentamerus limestone." The writer in a joint publication with Professor Schuchert [Science, Dec. 15, 1899], recognizing the distinct unit character of these strata termed them the "Kingston beds," later substituting for this term, which proved to have been employed by the Canadian geologists for a quite different formation, the name *Port Ewen beds* from their exposure near Port Ewen

station on the West Shore Railroad. The character of the fauna of these Port Ewen beds has not been well understood and it was this problem that carried Professor Chadwick into the field. Through the efforts of Mr Chadwick and Mr Shimer we have now a fairly adequate idea of the composition of the fauna of these beds.

Though, as already stated, the preponderance in the census of the species so far as known, is Helderbergian there is a noteworthy percentage of species that may be regarded as normal or at least usual to the calcareous Oriskany above. Various others have been recognized as passing upward from the Helderbergian into this Oriskany and Mr Chadwick in his closest analyses of the assemblage has pointed out its generally decadent condition as a Helderberg fauna.

There are also other species of very first import which have and probably must continue to be regarded as index fossils of the Oriskany formation. Chadwick determines *Megalanteris ovalis*, *Beachia suessana*, *Leptocoelia flabel-lites*, *Leptostrophia oriskania*, *Brachyprion majus* and *B. schuchertanum*. He indicates also the possible occurrence of *Spirifer arenosus*. Professor Shimer determines *Spirifer murchisoni* and *Meristella lata*.

It becomes now a question for very careful consideration whether a fauna lying beneath the normal position of the Oriskany beds and carrying such fossils as these, can with propriety be regarded a Helderbergian fauna notwithstanding its preponderance of Helderberg species. Upon this line of inquiry the recently discovered Oriskany fauna already referred to will throw additional light but the evident earlier immigration into the eastern New York region of Oriskany species than had before been noted is not in anywise out of harmony with the evidence of their association in the Gaspé basin at the northeast.

Monograph of the Eurypterida. It has long been the writer's purpose to prepare a revision of these remarkable crustaceans which occur in a variety and abundance in the rocks of New York unequaled elsewhere in the world. The Bertie waterlime outcrops in Erie, Cayuga and Herkimer counties and the Salina (Pittsford) shales in Monroe and Orange counties have now afforded a really extraordinary manifestation of the profusion of these creatures. Fifty years ago James E. De Kay and Professor Hall had described the commoner forms of these crustaceans *Eurypterus* and *Pterygotus* from the Bertie waterlimes, and Messrs Grote and Pitt some

years since published in the bulletins of the Buffalo Society of Natural Sciences accounts of supposed additional species occurring in these rocks at Buffalo. With the exception of the latter practically all accounts of these fossils in this State have been published in the reports of this institution; some notices in the *Palaeontology of New York*, volume 7; Mr Clifton J. Sarle described the remarkably interesting species from the Salina beds of Pittsford in Museum bulletin 69 and the writer the extraordinary fauna from the Otisville shales in bulletin 107. The collections of the museum representing these genera: Eurypterus, Pterygotus, Eusarcus, Hughmilleria, Stytonurus etc. are very extensive. All of the material described by Mr Sarle and the writer is here and recent additions to the specimens from these localities run up into hundreds of examples. Large collections have also been made by us in recent years from the localities in Herkimer county. The museum of the Buffalo Society of Natural Sciences is the possessor of most commanding collections of eurypteroids from the Bertie waterlimes in that city, which have been greatly enlarged of late by the enthusiastic interest of Mr Lewis J. Bennett, president of the Buffalo Cement Co. from whose quarries nearly all the specimens of these Bertie waterlime crustaceans scattered through the museums of the world, have come. In later years Mr Bennett has provided that all specimens taken from his quarries go into the museum of the Buffalo Society with the result that these collections have become fairly stupendous and vastly illuminating. The courtesy of a formal vote of the trustees of the Buffalo Society of Natural Sciences has enabled me to feel confident that this fine material will be subject to my use. It is my hope soon to reach a time when these investigations may be taken up for uninterrupted pursuit. Meanwhile progress is made as occasion affords.

Mastodons. In my report for 1903 I gave a summary of records of discoveries of mastodon remains in this State since the date of the first finding of the bones of the *Mastodon americanus* a short distance below Albany in 1705. The list there given afforded evidence of about 60 distinct occurrences of these skeletons. Last year I supplemented this record with four items. During the past season another discovery has been made. A brief notice of this follows and thereafter some notes of interest on other remains.

1907. *Perkinsville, Steuben co.* This skeleton was found in August last by John Morsch on his farm near the west end of

Perkinsville swamp and $\frac{3}{4}$ mile north of the railroad station of Portway. This swamp is a nearly equilateral triangle about $1\frac{1}{2}$ miles on the side. It occupies a shallow depression in a mass of morainic drift of unknown depth at the head of the Cohocton valley and is adjacent to the west side of a low ridge that separates the drainage area of the Cohocton river from that of the Canaseraga creek. It has an altitude of 1360 A. T. The surface layer of the swamp is black muck to a depth of 6" — 1', beneath which is a bed of nearly white marl 6" — 6' in thickness. The bones were found about 26 rods from the highway and 4 or 5 rods from the north edge of the black soil or border of the swamp. In digging about a small boulder Mr Morsch came upon one of the larger leg bones and proceeded to take out the remains of the skeleton. These bones lay largely in their natural position and while perhaps the numerical two thirds of the skeleton were preserved, the more conspicuous bones were fragmentary or wanting. At the conclusion of the excavation it was found that all four legs and feet, a large number of ribs and vertebrae, parts of the shoulder girdle and one ramus of the lower jaw with teeth had been recovered. The skull with tusks, greater parts of pelvis and scapulae were gone. It would seem that the animal in sinking into the mire had been left with the more protuberant portions of the body, the head probably thrown up and back, exposed to the air and inviting the attack of rodents. The absence of these parts when all the other bones had so compactly kept together, left little likelihood of their being found in any other part of the swamp. The preservation of the bones recovered was excellent for mounting and it is to be regretted that the specimen just missed being a desirable acquisition to a scientific museum.

1876. *Pike, Wyoming co.* [See Report Paleontologist, 1903 p. 932]. I append here some additional data concerning the Pike skull taken from a recently published account [Guide to the Genesee Valley Museum, Letchworth Park, by Henry R. Howland, 1907, p. 5].

These remains of a mastodon were found in the summer of 1876 in cutting a farm land ditch on the farm of Charles Dennis, on the outskirts of the village of Pike, which is about 7 miles from Glen Iris, and through which flows the Wiscoy creek, one of the tributaries of the Genesee river. The tusks were fortunately quite perfect and with them were found a part of the skull, some vertebrae and some foot bones. In order that these remains should be properly preserved they were at once purchased by Mr Letchworth

- who caused them to be mounted at the natural history establishment of Prof. Henry A. Ward in Rochester, N. Y. The prompt action taken in the matter resulted in the preservation of this valuable relic which was returned to Pike and allowed to remain on exhibition at the Pike Seminary until the completion of the Genesee Valley Museum Building in 1898. In 1904 the seminary building was destroyed by fire. The measurements of the Pike mastodon are as follows:

Length of skull, measured in a straight line from back to front...43½ inches
 Length of tusks, measured along lower curve 96½ inches
 Greatest circumference of the tusks... ..23 inches

I append here some historically interesting observations on the occurrence of mastodon bones in America made by Dr Johann David Schoepf in his *Reise durch einige der mittlern und südlichen vereinigten nordamerikanischen Staaten, nach Ost-Florida und den Bahama-Inseln, unternommen in den Jahren 1783 und 1784*, volume I, pages 408-15, 1788. This is a work of extraordinary interest which has been quite overlooked by students of American history. Its author was a surgeon in the Hessian forces sent over by George III and remained after the consummation of peace to travel through the country and collect scientific materials. The narrative gives a lively, anecdotal picture of the domestic and community life of the times interspersed with interesting reflections on the new government. Dr Schoepf was the author of other more technical works arising from his American experiences. He wrote a treatise on American Materia Medica, on the Reptiles of the country and was the first man of science to produce a special treatise on the geology of North America. His *Beyträge zur Mineralogischen Kenntnisse der Ostlichen Theils von Nordamerika und seiner Gebürge* published in 1787 is characterized by acute observation and keen interpretations of geological phenomena. It was 50 years in advance of the times and wholly ignored by the first American workers in the same field. Of these books only his Materia Medica was translated into English. German was unpopular, it was the language of the hated Hessians and of the Hanoverian house. So these very illuminating and interesting volumes have been buried as deep as Captain Kidd's treasure.

Among the natural rarities of the Kentucky regions, the many large teeth and bones belonging to an animal no longer existing in all America have long excited the wonder of all travelers. The place where they were first discovered in great heaps is a low hill, on the east side of the Ohio, 2-3 miles from its banks and about 584 miles below Fort Pitt, measured along the course of the river. At the sources of a little brook where there are extensive salt licks, the

heavy tread of the buffalo herds which gather there, with help of wind and weather, have uncovered these bone heaps which are buried only a little way beneath the surface. The mass of bones is said to be very considerable; to judge only from what lies bare or projects from the surface, some estimate that there must be the ribs of at least 12-15 animals. How many more yet may not be buried under the earth? It was perhaps a numerous herd of beasts that here found their common grave. As to the former owners of these bones, the native Americans have just as little knowledge as the opinions of the most learned students of nature have imparted. On account of the immense size of the bones and of the elephantlike tusks found among them the natural inference has arisen that they are remains of elephants formerly native in this part of the world or by accident brought here and destroyed, and one is all the more justified in the opinion, which has in itself nothing contradictory, as in so many other regions similar elephant bones have been discovered where the race of elephants is as little native as in America.

By exact comparison between these bones from the Ohio and other bones and teeth from living elephants, certain variations have been marked which raise new doubts. Particularly it has been found that the thigh bones on the Ohio are thicker and stouter than those of the well known elephants; that the tusks are often somewhat twisted and especially that the crowns of the molar teeth are furnished with wedge-shaped elevations which the present elephant does not possess. For these, and especially the last reason, the learned Dr Hunter¹ believes himself justified in assuming that these American bones and teeth must have belonged to a flesh-eating animal larger than the known elephant. From their relations to the bones found in Siberia, Norway and other northern lands of the old world, Raspé seeks to make it appear probable that they are the remains of a great animal (elephant or not) which was of a special species and originally was adapted to colder regions, the whole race of which has from unknown causes now become extinct.²

With this view Daubenton and other savants agree and Mr Penant believes that this still undetermined animal may yet be encountered alive somewhere in the interior unknown regions of America, and calls it therefore in his synopsis, the *American elephant*. If now, remains of the hippopotamus have not to some extent on the Ohio been mixed with those of the elephant and hence given rise to errors, this idea needs further elucidation.

In Pittsburg I saw in the possession of an artillery officer a thigh bone, a molar and a tusk which he had himself brought from that region. The thigh bone, though quite dry and here and there with

¹ Philos. Trans. 1768. v. LVIII.

² Philos. Trans. 1769. v. LIX. Dissertatio epistolaris de Ossibus & Dentibus Elephantum, aliarumque Belluarum, in America boreali etc. obviis, quae indigenarum belluarum esse ostenditur. I. C. Raspé

some of its substance lost, weighed not less than 81 pounds, was 3 feet, 9½ inches long; in the middle where it was comparatively flat its circumference was only 20 inches but on the lower joint 2 feet, 6½ inches. The tusk was 3 feet long, 4 inches in diameter at the end, but it was not entire. I could see no evidence of its being twisted. The molar tooth which I received as a gift, weighed easily 6 pounds and the crown was armed with three wedge-shaped elevated processes.¹

The first two pieces were given to the library in Philadelphia where I afterward had the opportunity of seeing them. As an incident it may be observed that the officer referred to, in order to fetch these three pieces from their locality a few miles from the boat on the Ohio, paid one of the soldiers a slight pourboir of 1000 paper dollars equivalent in value to 2400 Rhenish florins. Besides the molar referred to I have seen in Philadelphia in the collection of Mr du Sumetière, several others, found in other parts of America. These were all quite similar and some had the elevated processes of the crown particularly sharp, while in others they were low. If this style of tooth only were always found among the elephantlike bones discovered at various separated places in America, then the assumption that they belonged to an ancient race of American elephants would be much strengthened. It has recently become known that the spot on the Ohio is not the only one in North America where similar remains of these animals are found. Teeth have been discovered on the Tar river in North Carolina, near Yorktown in Pennsylvania and in Ulster county in New York. Catesby mentions an elephant tusk dug up in South Carolina; Kalm an entire skeleton in the country of the Illinois and others have been found in South America. The largest collection of the Ohio fossil bones is in the possession of Dr Morgan of Philadelphia. On account of the trackless distance it was formerly very difficult to obtain these remains which had to be brought by a long circuit down to New Orleans and then up to Philadelphia by sea. Now the settlement of Kentucky affords better prospect of an early and more exact knowledge of the remarkable bone deposit. It would be superfluous to repeat the various theories which have been advanced to explain the occurrence of this accumulation of remains of so very strange an animal. Floods, marvelous changes of climate, of the earth's center of gravity and of its axis, have been invoked. The American hunters satisfy themselves with the explanation that these were real elephants killed off by a hard winter which they were not able to withstand and to support their opinions they point out that often an extraordinarily

¹This molar is now in the very fine scientific collection of Privy Counselor Schmidel of Ansoach and both in respect to weight as well as in entire structure entirely different from the elephant's tooth with which the Privy Counselor has compared it. The molar of an elephant which Mr Sparrmann has described, weighed only 4½ pounds.

severe winter kills off other species of animals specially acclimated to this part of the world.¹

It is easy to see that such a restricted cause could have no effect in accumulating the deposits of these animals in the tropic South America. No one, however, has been happier in his theories upon this problem than the author of the *Essai sur l'origine de la population de l'Amerique*, volume II, page 298, who regards all these bones (whether in jest or earnest, no one knows) as nothing more than the remains of a troop of fallen angels (equipped with six-pound back teeth!) which, according to his notion, were the original inhabitants of the earth in its primitive and glorious state, until, because of their transgressions they were condemned to universal destruction near their own earthly habitation, whereupon the rest of the purified planet was cleaned up for the reception of the present improved race of mankind.

Devonic crinoids of New York. The work on the New York crinoids has shown a fauna of exceptional and unexpected interest. Thus far nearly 40 genera have been recognized, some for the first time in Devonic rocks and the number closely approaches the total genera hitherto known from the Devonic rocks of the world. The group of the Inadunata is well toward completion and many drawings of the species made. These investigations are being made by Mr Edwin Kirk.

Paleozoic corals. Excellent progress has been made by Dr T. Wayland Vaughan on the analysis of the genera of the Paleozoic corals. Dr Vaughan labors under the disadvantage of endeavoring to rescue the results of previous attempts made here to define and illustrate these fossils but his efforts give promise of an eventually satisfactory outcome.

Devonic fishes. A monograph of the Devonic Fishes of New York by Dr Charles R. Eastman was issued during the year as Memoir 10. This work affords a comprehensive survey of present knowledge of the fishes obtained from the rocks of this State and though these remains are in many instances in highly incomplete condition, it has laid the foundation of future study of these organisms. Moreover the author's wide acquaintance with his subject has given his general conclusions more than ordinary interest and force. Under the title "Zoological conclusions" problems of the evolution of the fishes are discussed, such as the origin of the cel-

¹ In the severe winter of 1779-80 a great number of roe deer were found dead here and there in the woods in the interior of America and its mountains; often many together near the frozen springs where they were accustomed to drink or to lick salt. A multitude of birds and other animals were also killed that winter.

shaped fishes among races which have not progressed, the origin of the paired fins and the development of the effective fins. The chapter entitled "Geological conclusions" is of special interest as indicating the distribution and migrations of the early fish fauna and may well be reproduced here.

GEOLOGICAL CONCLUSIONS

It will be convenient to include under this head certain topics whose practical bearing is of chief interest to the geologist, although the evidence involved is partly zoological, and in still larger part geographical, or paleogeographical. We refer to such matters as relate to the areal and vertical distribution of Devonian fish life, the dispersion of new types and varieties, migration, succession and occasional recurrence of faunas, and indications furnished by the fossils themselves in regard to climatal and physical conditions, either those of local nature, or others prevailing over wide areas. Thus, by way of illustration, we are able to affirm from the general complexion of ancient faunas, that the climate of arctic regions was notably warmer during the Devonian and late Paleozoic than at subsequent periods. We are in possession, also, of a large fund of evidence regarding migrational movements, and can delineate with great exactitude a number of physical barriers that were interposed to lines of migration. Means are at hand in very many cases for distinguishing between free swimming inhabitants of the open sea and other forms whose structural organization proves them to have been bottom feeders, mud grovelers, or frequenters of estuaries and fresh-water lagoons. Manifestly inferences of this nature are of far-reaching geological significance, besides having a direct practical application. Finally, a knowledge of the relations of successive vertebrate faunas is an important corollary to the information we have concerning fossil invertebrate faunas, the two categories being mutually complementary, and taken altogether are essential to a natural classification of geologic formations.

We may consider first some of the more general conclusions derived from a study of the distribution of Devonian fishes, having special reference to those of New York State. In the first place it is necessary to bear in mind that the Devonian faunas of the interior of North America announce themselves as belonging to two distinct types, one being more or less confined to the eastern, and the other to the west central United States and Canada. Or, to put it differently, it is possible to recognize within the interior of our continent two more or less distinct geological provinces of the Devonian, differing from each other and from the more remote areas lying to the westward (Cordilleran and continued border provinces) in their respective faunal characteristics. The eastern interior province, which has received the name of Appalachian, is typically represented in New York State, but extends westward into Ontario and Michigan, and southwestward into the Ohio valley region,

forming circumscribed areas known as the Cumberland and Indiana basins. The western interior province is represented typically in Iowa, and was more or less effectively separated from the eastern during early and Middle Devonian time. Its limits are coextensive with the so called Dakota sea, which was open to the northwest during the mid-Devonian through Manitoba, the Mackenzie Basin, and across Behring straits into Siberia, but was probably closed to the northeast. The suggestion has been made, and indeed been received with some favor, that intercommunication existed during the mid-Devonian between the typical Iowan and Eurasian faunas by means of a northeasterly passageway through Manitoba, Hudson and James bays, Greenland, Spitzbergen and circumpolar regions. More recently, however, weighty objections have been opposed to this theory, and it has been asserted very emphatically by Professor Schuchert that there is not the slightest reason to connect the Hudson and James Bay Devonian with that of the Dakota sea (or western intercontinental province). It is further denied by the same author that this latter province was in connection with a southern ocean, extending into Brazil, until Hamilton time. On the other hand students are agreed that communication was maintained between the Appalachian province and that of the southern hemisphere during the mid-Devonian. Concerning the pathways that were open between the Appalachian and Eurasian provinces during the Middle and later Devonian there are still some differences of opinion.

It will be observed accordingly, that the Devonian in this country was preeminently an era of provincial development of marine faunas. Furthermore it appears that diversity in this respect is more strongly marked in the Appalachian region, where there were varying conditions of sedimentary deposition, than in the Cordilleran and continental border regions, where these conditions were more uniform. Thus, in the eastern province, as Professor Williams has pointed out, diversity and alternation of deposits are accompanied by numerous successive and distinct faunas; in the extreme western regions, uniformity of prevailing calcareous sedimentation for long periods is characterized by the abnormally long continuance of many Devonian species; and the central continental province, midway between the two, is marked by the unmistakable recurrence of Devonian species well along into the Carbonian. Another noteworthy feature of the Devonian which has been developed very fully and clearly by the painstaking investigation of Dr Clarke is that faunal changes within the ancient Appalachian sea are sometimes so precisely indicated that it is possible, as in the case of the Portage group, to trace the boundaries not only of local provinces, but of local subprovinces characterizing the stage in question. Thus, the Genesee province of the Portage is divided into Chautauquan and Naples subprovinces on the basis of differences in their faunal facies; and an interesting peculiarity of the Naples subprovince is that, as stated by Dr Clarke "with contemporaneous faunas of the Appalachian gulf" its fauna "has in its purity no organic relation, direct or sequential."

It is very necessary to understand this matter of the provincial character of Devonian faunas in North America. Also, in tabulating the facts of distribution, one must keep in mind the inferred lines of intercommunication between those provinces that were connected, as well as the position of barriers between others that are known to have been separated. The data upon which our information in regard to these matters repose have been brought together chiefly by workers in invertebrate paleontology, and as the evidence at their disposal is enormous as compared with that obtained from a study of the vertebrates alone, no deductions drawn from the latter are likely to prejudice the results depending upon a different class of remains. In point of fact, no discoveries of fossil fishes have yet been made which tend to contradict or discredit conclusions already established on the basis of fossil invertebrate evidence. The known distribution of the former is in all respects consonant with, and one is tempted to add, confirmatory of the principles that have been formulated from a study of the latter. We find simply that the more mobile free-swimming contingent of Devonian faunas followed the same routes and penetrated, probably with greater facility, into the same areas as the slower moving invertebrate associates of the original fauna, wherever we are able to trace its migrations.

Nevertheless, some facts relating to the distribution of Devonian vertebrates stand out with such distinctness as to attract particular attention. The earlier Devonian horizons in New York State are singularly deficient in fish remains, and the faunas that appear successively in the Meso- and Neodevonic are introduced with little or no foreshadowing, save that the members of the Hamilton fish fauna are largely a residuum or evolution product of the preceding Onondaga congeries. Clearly, however, the Mesodevonic fish faunas are not indigenous in the Appalachian basin for we meet with practically the same assemblage in rocks of equivalent age elsewhere, as for instance, in the Eifel district (Calceola beds) and Bohemia (étages F² and G¹-G³); and besides, the Oriskanian fauna contains no elements, so far as known, out of which the Onondaga might have developed. The vertebrate portion of the latter is, therefore, quite unmistakably an immigrant fauna. That it did not come in from the northeast may be asserted with equal confidence, for none of its members are represented in the maritime provinces of eastern North America, nor indeed, in the Lower Old Red sandstone of North Britain, Greenland or Spitzbergen. As in the case of the majority of invertebrates, the Onondaga fish fauna came in from the west, and in course of time very probably withdrew westward, many of its characteristics persisting into the Hamilton of the western interior province. The Hamilton piscine fauna is so obviously the descendant of the preceding Onondaga, and these two together have so much in common with the Eifelian, Bohemian and Russian Mesodevonic, as to confirm in the strongest possible manner the contention of Professors Clarke and Schuchert that the Ulsterian and Erian should be recognized as divisions of the Middle Devonian.

Attention has been called by Professor Schuchert to the similarity between the Middle Devonian fauna of the Hudson Bay region, and that of the Mississippian Onondaga. A number of considerations are proffered to show that while each of these faunas has its individual facies, yet both are of that type which characterizes the American, in contradistinction to the Eurasian province; and moreover, they differ both in horizon and facies from the Stringocephalus zone of western and northwestern Canada. It is inferred, accordingly, that the Hudson Bay Devonian area was entirely shut off from communication with the Dakota sea, but on the other hand it is thought probable that intermittent connection existed between the former basin and the Mississippian sea. An opening is also posited by the same writer, lasting throughout the Devonian, between the Appalachian and Eurasian provinces, the route leading through the so called Connecticut straits, thence along the Gulf of St Lawrence and across the Atlantic. Having established what seems to him a reasonable basis for the propositions just stated, Professor Schuchert sums up his conclusions in regard to Middle Devonian faunal distribution in the following paragraph:

"The Onondaga fauna is the outgrowth of the Oriskanian fauna of the North Atlantic type plus the migration during Onondaga time of other North Atlantic forms by way of the Connecticut trough and invasions from the far south through the Indiana basin. The Hamilton fauna is the descendant of that of the Onondaga plus North European migrants by way of the Connecticut trough, South American arrivals by way of the Indiana basin, and slight invasions from the Dakota sea by way of Traverse straits. These three openings then remained in existence during the greater part of Upper Devonian time."

This rather full statement in regard to conceptual waterways has been made not for the purpose of criticism, but in order to synthesize as far as possible certain elements of apparently conflicting nature. The test of a sound judgment is its ability to unify various and sometimes even dissonant concepts. In the present instance it becomes necessary to reconcile with the evidence furnished by Helderbergian and Oriskanian invertebrates in favor of an invasion from the northeast, certain other evidence that appears at first sight discordant, namely, the failure of any Lower Devonian vertebrates to take part in the migration. As will be seen from an inspection of the faunal lists, the abundant and rather diversified fish fauna occurring in the synclinal basin of the Restigouche near Campbellton, N. B., is without a single representative in rocks of Lower or Middle Devonian age in the Appalachian province. No traits are observed in the Onondaga or Hamilton fish faunas which can be ascribed to an immigration from eastern Canada by way of the putative water route called by Clarke the "Appalachian strait," and by Dana the "Connecticut trough," which is supposed to have been open during the late Silurian and greater part of the Devonian. None of the Appalachian Mesodevonic vertebrates can be regarded as the genetic descendant of forms that

existed at an earlier period in the maritime provinces in eastern North America. The problem is to reconcile this diversity of evidence without contradiction, and it is believed that a solvent will be found in Dr Clarke's recent determination of the Gaspé sandstones as of later than Oriskanian age.

In his sketch of the geology of Percé, published in 1904, Dr Clarke declared that the fairly rich marine fauna of the lower beds about Gaspé Basin reveals evidence of both early and late Devonian age, and that the prevailing sedimentation is of the same aspect as characterizes both in New York and Europe the deposits of the Devonian or Old Red lakes and lagoons. This preliminary statement strikes at the root of the whole matter, and sounds the keynote of an interpretation which has since been more fully evaluated by the skilful New York State Geologist. The results of his extended investigation of the invertebrate paleontology of the Gaspé Devonian remain as yet unpublished, but an idea of their general import may be gathered from the following extract from a private communication, which we are enabled to present here through the courtesy of Dr Clarke:

"The profusion of evidence that has been obtained from a study of invertebrate paleontology seems indubitably to indicate that the Gaspé sandstones are not of the geological age assigned to them by Logan and the Canadian geologists generally. That is to say, they are not Oriskanian, for, though they contain certain Oriskany species, these are the survivors of the earlier limestone faunas of that region persisting during the incursion of a distinctively Hamilton Lamellibranch and Brachiopod fauna from the southwest.

Dawson subdivided the Gaspé sandstone into three parts: the lower division coordinated with the Oriskany and Onondaga; the middle, equivalent to the Hamilton group; and an upper conceived to be equivalent to the Chemung. This entirely arbitrary subdivision was based upon the distribution of the terrestrial flora, and is not, I think, in any way borne out by the present evidence. The weakness of the comparison lies in the attempt to correlate with true marine deposits the very heavy mantle of sands of telluric, delta or lagoon origin conformable in every way physiographically to the Old Red deposits elsewhere, the few marine fossils which it contains being the accumulation of overwash from outside during times of stress. Ells and Low have suggested the probability that the fish-bearing beds at Scaumenac and Campbellton were laid down in an area separated from the more northerly region by barriers of old land, and in my judgment this is an entirely probable condition, not eliminating the possibility of connection between the two basins at some point further westward."

Indeed, as early as 1883, it was noted by R. W. Ells that a number of invertebrate fossils from the northern limit of the Gaspé Devonian were "strongly typical of the Hamilton formation," thus leading to the inference that "the Gaspé sandstone series, of the coast, is probably of the same age, though the absence of typical shells in a large portion of it makes their separation more difficult." The

same author had previously described the beds at Campbellton, N. B., before they were found to contain fish remains, and had pronounced upon their equivalence with the lower part of the Gaspé sandstones. This opinion was based upon evidence of paleobotany, and, having been confirmed a few years afterward by J. W. Dawson, is now generally accepted. Indeed, Logan seems to have entertained similar views as early as 1863 [Geol. Can. p. 450]. As for the plant and fish-bearing beds at Scaumenac bay, on the Quebec side of the Restigouche, these are asserted by Dawson to be "no doubt the equivalents and continuation of the upper part of the Gaspé sandstones." In the absence of a more precise indication of their age, these beds are commonly referred to as Upper Devonian, and their vertebrate content favors that conclusion.

In the light of Dr Clarke's coordination of the Gaspé sandstone series with rocks of Postoriskanian age, we are no longer required to look in that direction, nor to the probably contemporaneous Campbellton fauna for the origin of the Onondaga fish fauna found in New York State. On the other hand it may be conceded as rather more likely that there was some movement among vertebrate organisms in the reverse direction, for such an hypothesis would account for the presence of a typical Onondaga species, *Macbairacanthus sulcatus*, at different levels in the Gaspé series (Logan's Divisions 1 and 6). The genus *Cephalaspis* is common to both the Gaspé series and Campbellton beds, and together with the majority of forms from the latter horizon is indicative of Old Red sandstone conditions.

Reverting now to the Hudson Bay Middle Devonian fauna, we find that, as listed by Whiteaves, it is unmistakably of about the same age as the Onondaga. According to Schuchert, its faunal facies "is more that of the Mississippian type than any other known in America." This similarity is therefore held to indicate that there was at least intermittent connection between the two basins during Onondaga time, and persisting well into the Hamilton. It is admitted, however, that the question as to how the stream of migration entered the Hudson Bay area during the Middle Devonian is not so easy to answer. Precisely at this point some light is thrown on the problem by vertebrate paleontology. A number of specimens of *Macropetalichthys sullivanti* (= *M. rapheidolabis*) are recorded by Bell and Whiteaves from the country immediately west and south of Hudson and James bays. This exclusively Onondaga species (Mr Schuchert inadvertently calls it a Hamilton fossil) is most abundant in Ohio and Indiana, and decidedly less common in New York State. The same genus, represented by some two or three species, occurs also in the Eifelian Devonian, which is equivalent practically to the Onondaga, and in the slightly earlier horizon in Bohemia designated as étage G¹. No trace of it occurs, however, in the Mesodevonic of the maritime provinces of eastern North America. One may readily infer that this genus and its various associates are indigene in Bohemia, a part of the vertebrate fauna from étage G¹ being inceptive in étage F.

Thence it spread northeastward into Russia, westward into the Eifel District, and northwestward into the Hudson and James Bay region. From this latter region we may suppose it to have passed southward through Ontario by means of a passageway connecting with the Appalachian gulf over the area that is now occupied by Ohio and Indiana, where the fauna reached its climacteric. The most conspicuous elements of the fauna are Arthrodirees and Ptyctodonts, groups which began immediately upon their introduction to attain a most remarkable development. Throughout the Hamilton and later Devonian, conditions must have been eminently favorable in the Appalachian sea for the further specialization of armor-clad Dipnoans of the type represented by *Dinichthys* and its congeners. Like their earliest predecessors, they became of greatest importance locally in Ohio.

The wide interest to all concerned with the philosophy of paleontology and the far-reaching significance of such detailed investigations as are brought together here, are very effectively set forth in the following paragraphs.

There are no other means for attaching significance to a truth except by perceiving its relations to other truths. Thus far we have been concerned principally in assembling, and to some slight extent in correlating recognizable truths; in a word, facts of observation have been brought into orderly array. The next step is to examine them in their bearing upon other known facts, to deduce their general significance, and to assign to the results a commensurate worth in surveying the whole field of paleontological inquiry. The ultimate yield of scientific study is the fruition of philosophical ideas.

To obtain a large perspective of the body of facts at our disposal, it is desirable to marshal them in different ways, and to examine them from different points of view. Their relevancy from a geological standpoint needs consideration, with the object of drawing from them conclusions of geological import. In still larger measure it behooves us to consider them as an increment to zoological science, compacting its substantial framework and vastly extending our knowledge of the evolutionary history of organisms. Are we proposing to ourselves an explanation of life, our vision must include not only living matter as we find it today, but also those manifestations of it that existed in the remote past. Side by side with the development of the individual we must examine the evolutionary history of the race. The more we learn of vital processes now operating, the better able are we to understand their operation in times anterior to our own. Comparisons that are enlightening when made between members of the modern fauna may often be profitably extended so as to include members of extinct faunas. Where the time element acts as an impediment to our studies it must be eliminated so far as possible. Zoology of the past does not differ in essence from zoology of the present, any more than ancient history differs fundamentally from modern.

Among other large problems that suggest themselves in reviewing our knowledge of Devonian fishes are those relating to the habits and mode of life of the creatures represented, their adaptation to physical environment, the effects of such adaptation as manifested in their structural modifications and subsequent racial history, and finally the important topics of migration and geographical distribution. All of these issues, though subsidiary to the main theme, offer nevertheless fruitful fields for exploration. It would take us too far astray from the immediate purpose of this paper to consider all of these matters seriatim, particularly as materials are already at hand for those who may wish to pursue them further. For instance, in regard to the habits and mode of existence of ancient forms of fish life, many suggestive hints are contained in the writings of Claypole, Dollo, Jaekel, Kemna and others.

A large and very important literature exists on the subject of faunal migrations in general, and geographical distribution, which will be referred to later. The question of adaptation to environment has been less fully treated than others in the above category, since, from the nature of the case, our information is more deficient in this respect. The viewpoint, however, is exceedingly instructive, and such light as is obtainable from it is most welcome. That we have not overstated the truth must be clear to all who have gained a right understanding of the working of this principle in analogous cases. As convenient an illustration as any is furnished by human history. One of the notable phenomena in the annals of mankind, and one of the most beneficent in its subtle and far-reaching consequences, is the marvelous civilization attained by the ancient Hellenes. Yet the unfolding and superb blossoming of the flower of Greek genius, together with its rare beauty while it lasted — this surprising spectacle utterly fails of comprehension except as we take account of influences of heredity and environment. To understand Athenian character and habits, or to attempt to account for that civilization which flourished, as Milton says,

Where on the Aegean shore a city stands
Built nobly, pure the air, and light the soil,

it is above all things imperative to understand the conditions of Attic soil and climate. For as soon as one inquires critically into the physical surroundings of the classical Athenian, one discovers that his culture is not primarily dependent upon his peculiar character, but is very largely the resultant of his outward circumstances, and influenced to a marked degree by his climate. One perceives, therefore, that ample justification exists for the following statement, taken from a very readable work on classical antiquity (Tucker's *Life in Ancient Athens*), with which we will conclude our remarks on this head:

“From the bare facts that the Athenian lived in a land which supplied a frugal and simple, but sufficient and wholesome diet, in a climate which makes for sociable outdoor life without producing languor, in an atmosphere which sets off whatsoever things are

shapely and beautiful, on a soil furnished with a plentiful supply of excellent material for plastic art — from these simple facts should we start before we attempt to understand those ways which characterize what is loosely called his 'civilization.'"

There is yet another way in which we may view the sum total of facts resulting from paleontological inquiry, or even the small part of it which is here brought together. We may seek to interpret our collection of facts from the humanistic standpoint. Granted that this knowledge does not appreciably affect our vital interests, what is it worth to us in other respects? How far does knowledge of this sort tend to enlarge human consciousness? Does reflection upon it tend to vivify our perception of the workings of natural law? And if so, does there not arise from fulness of perception a keener sense of the nobility and dignity of the relation man bears to the wonderful planet he inhabits, and is there not a quicker response on his part to the suggestions which that clarified sense awakens? There can be but one answer to this last question. It is inevitable that there should be a prompt and vigorous response from within when once it is realized that "whatever else man may be, he is the sum of a series of actions linked with all that has gone on before upon this earth." The experience is no less common in paleontology than in other sciences that, after one has gained sufficient insight, ideas and impressions of a certain sort enter our minds, sharpen our vision, and enlarge our mental horizon by elevating us to a summit of observation unattainable before. Possibly there belongs to paleontology an even larger quota of these emancipating conceptions than is true of other sciences, in view of its predominant historical interest — being, as it were, a limitless extension of universal history.

To realize to some extent what the loss of these emancipating conceptions would mean to us, it is only necessary to contrast the olden-time idea of creation with modern evolutionary beliefs. Or, regarding the paleontological record as the continuous unfolding of consciousness, whose beginnings are coeval with the origin of protoplasm, and whose crowning resultant is man, we may picture to ourselves the contracted outlook, the void in our knowledge, and the impoverishment of ideas that would be our portion in case no documents had been preserved to instruct us of the far distant past. Imagine our loss were the records of early human history obliterated. What would be our poverty had the grandeur of Rome been dissolved into a mass of meaningless ruins, had the splendid story of Greece and Athens been blotted out, had we remained unconscious that Marathon was ever fought, or that such a one as Socrates had ever lived; had we no line from Homer, no thought from Plato, no inspired word from Palestine vibrating through the ages!

Again let it be said that conceptions of this nature are not foreign to the scope or peculiar province of paleontology. They are, in fact, inherent in all science; they are not mixed with it, but combined with it, and hence do not properly form either its distillate or residuum. If there be any who question how far these ideas are relevant to the

study of fossil fishes, we may be allowed to recommend all such to read the lives of Louis Agassiz and Hugh Miller, especially the recent character study of the latter by Mr Mackenzie (1906). An answer is recorded there so plainly that he who runs may read. Wherever the work of Miller is remembered and appreciated, it is not for the value of his discoveries, nor for his contributions to science, but for the native shrewdness, clearness, intensity and discernment with which he drew philosophical conclusions from the study of nature. And his impulse in this direction was first quickened and set in motion by his discovery of fish-bearing nodules in the Old Red sandstone of the north of Scotland. We can not forbear in this connection to quote the following passage from an address delivered a few years ago by M. Albert Gaudry, president of one of the sections of the French Academy:

"Quand on passe à Cromarty, dans le Nord de l'Écosse, on aperçoit une colonne érigée en l'honneur de l'ouvrier carrier Hugh Miller; en cassant des pierres, l'ouvrier de Cromarty admirait qu'on y trouvât des créatures fossiles, et il en tirait des pensées si hautes qu'il est devenu un des paléontologistes célèbres de la Grande-Bretagne. Beaucoup de gens sont comme Miller: c'est chose étonnante que l'ardeur avec laquelle, dans tous les pays du monde, on brise les roches pour surprendre les secrets des temps passés: bâtis hier, les Musées de paléontologie sont aujourd'hui trop petits."

Graptolites of New York. At this writing the second volume (Memoir 11) of the monograph of the Graptolites, prepared by Dr Rudolf Ruedemann is leaving the press. Volume 1 (Memoir 7) on the species of the earlier rocks was issued in 1905. The present work embraces the later forms and completes the subject embracing most if not all species reported from the United States of this interesting and long extinct group of organisms. In this volume there are altogether 149 species and varieties of graptolites described. The greater part of these come from the upper part of the Lower Siluric (Champlainic), the great majority from the Trenton shales; a smaller part from the Siluric zones distinguished in the upper part of the Lower Siluric, which broadly correspond to the Black river—lower Trenton, middle—upper Trenton, Utica and Lorraine beds. All of these can be correlated with well known European zones.

In view of the fact that the slate belt of eastern New York has furnished a practically complete succession of graptolite beds, extending from the top of the Cambric to nearly the top of the Lower Siluric, the conditions of deposition of graptolite beds are fully investigated and the conclusion reached that graptolite shales are, as a rule, deposited in the same region for longer intervals than most other fossiliferous rocks. This leads to the inference of the

origin of their beds in deeper parts of the sea than most of the fossiliferous rocks. This conception is found to be in full accord with the views held by Suess, Neumayr and Haug in regard to the deeper sea origin of the deposits in geosynclines and is also applicable to the Paleozoic Appalachian geosyncline, as far as the Lower Siluric era is concerned. The graptolite shales of the Appalachian geosyncline reappear in Arkansas and the Indian Territory and again in the Rocky mountains, but are absent in the vast intervening area. These facts suggest that the Appalachian and Rocky mountains geosynclines were connected in the south by a westerly bend of the Appalachian geosyncline now buried in the Gulf of Mexico or the Gulf States, a northern embayment of which is, however, still exposed in Arkansas and the Indian Territory.

A synoptic view of the genera of the graptolites of the United States is given. This brings out graphically the fact of three successive culminating periods of the graptolites, each marked by the appearance of a new group or order that has given to the class a new lease of life by advancing to a new structure. The first of these is the dichograptid culmination in the Beekmantown shale; the next the dicellograptid-diplograptid climax in the Trenton shale and the last the monograptid culmination in the Siluric. The structural and phylogenetic causes of these culminations will be made the subject of a separate study.

A separate chapter is devoted to the morphology of the spines of the graptolites since these represent one of the striking features of numerous forms. It is found that in the great majority of forms the spines are placed distinctly on the most exposed parts in response to stimuli from the environment. In many others (dwarfed phylogenetic forms) a general spinosity is clearly but an expression of waning vital power and in a third important group, the most typical representative of which is *Glossograptus*, a general spinosity is produced by a tendency to repetition of the lateral spines commonly found in any graptolite at the sicular extremity. In *Lasiograptus* and related forms finally the spines were found to result from the suppression of thecal structures caused by restraint of environment, or in an endeavor to lighten the periderm.

Another chapter was invited by the multitude of forms of the appendages of the sicular extremity of *Climacograptus bicornis* occurring in the Normanskill shales. It was found that the several varieties based on the forms of these appendages are all connected by transitions and represent one complex system mark-

ing the climacteric period of the species. In a further chapter the possible influence of the presence of spines on the development of a retioloid structure in the periderm is investigated and the inference attained that even the spinose forms of *Diplograptus* possess in their thick periderm a layer of retioloid meshes, and of stronger ledges, and that the development of this layer is roughly proportional to that of the spines. This cause has combined with the tendency of the rhabdosomes to become lighter after the floating and swimming habit had been adopted, and produced the order *Retiolitidae* with a reticulate periderm.

The dilatations, "disks," wings or vesicles of the nemacaulus of *Diplograptus*, *Climacograptus* and *Cryptograptus* are separately considered and evidence brought forward to show that they were inflations of the outer periderm of the nemacaulus through which the virgula or axis passes uninterrupted.

The verification by a recent investigation by Schepotieff, of a former observation by the writer, that the axis of the sicula (the virgula) passes through the nemacaulus and into the rhabdosome, is discussed in a further chapter. Other chapters on the morphology of the graptolites are devoted to the asymmetric section of the rhabdosome in some graptolites (as *Climacograptus typicalis*), to the axes of the *Dicranograptidae*, the morphology of the thecae of the *Dichograptidae* and *Dicranograptidae*.

In a part entitled "Notes on Phylogeny" the phylogenetic relations of the *Leptograptidae* and *Dicranograptidae* are first discussed and the derivation of *Dicranograptus* from *Dicellograptus* shown. It is argued that the branches of the *Dicranograptidae* formed together always a more or less slender double spiral whereby certain advantages of the arrangement of the thecae and a great elasticity of the suspended rhabdosome were attained, but at the same time the strain at the further (sicular) end where the two branches are connected, increased; hence the formation of the biserial portion in *Dicranograptus* to strengthen this end.

A synoptic and synonymic list of graptolites recorded from North America concludes the general part of the memoir.

A Devonian brittlestar

In a recent publication¹ I called incidental attention to the discovery by D. D. Luther of specimens of *Helianthaster* in the Portage (Cashaqua) shales at Interlaken, N. Y. a village lying on the divide

¹ Report State Paleontologist 1906, p. 36.

between Seneca and Cayuga lakes. The discovery was an interesting one as the genus had not before been known in the American Paleozoic rocks, but no attempt was then made to analyze the structure of the specimens. A halftone plate of the better of the two individuals found was given and the intimation made that the species was not identical with the German *H. rhenanus* F. Roemer, the only form hitherto referred to the genus. The publication of this figure induced Prof. H. P. Cushing of Adelbert College, to call my attention to a slab of similar fossils in his possession which had years ago been acquired by the late Samuel G. Williams while professor of geology at Cornell University. This specimen has been placed in my hands; it is from the Portage beds at Earl's quarry, Ithaca.

We have now five individuals of this species of *Helianthaster*, the two from Interlaken of which one displays the ventral aspect of the arms and the other appears to be an external cast of the same side of another individual; both of these are damaged about the oral region. The Earl's quarry slab carries three individuals all in ventral aspect, and all casts. Of one of these the mouth parts are missing but in the other two they are retained, in one particularly well. Not long ago I was successful in obtaining a magnificent specimen of *Helianthaster* from Bundenbach which has admirably lent itself to preparation and which elucidates some points of structure not recited by Stürtz in his admirable account of the structure of *H. rhenanus* and is indeed of much more commanding proportions than the material illustrated by that author.

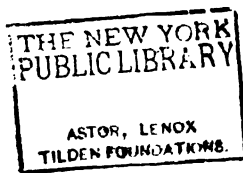
As this genus is a novelty in New York paleontology it is of interest to call attention to these recent discoveries with such detail as the preservation of the specimens permits. *Helianthaster*, from its original description by F. Roemer¹ was a hardly recognizable genus. It was only after Stürtz rediscovered and analyzed the species from the Bundenbach shales that an approximate conception of this very commanding ophiuran was attained² and it is in the light of these determinations alone that the specimens here considered can be intelligently interpreted.

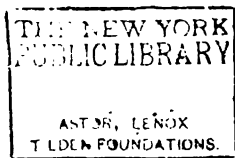
In regard to *Helianthaster rhenanus* the description given by Roemer in founding the genus [*op. cit.* p. 147] was based on specimens pyritized but involved in the shale in the usual mode of preservation of the Bundenbach starfish and no attempt was

¹ *Paleontographica*. 1862. v. 9.

² *Paleontographica*. 1885. 32 81, pl. 8, fig. 3, 3a; 1889. 36: 218, pl. 26, fig. 14, 15, 15a; pl. 27, fig. 14.

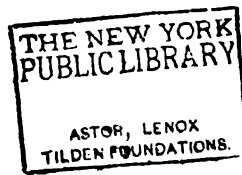
Helianthaster rhenanus F. Roemer
Stüztz's figure (Paleontographica, v. 36, pl. 27) slightly reduced; showing the ventral aspect





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oral plates with the spinous oral processes. The rec-
the base of each arm is narrow, long and acute, much

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made to solve the difficult problem of removal of the matrix and exposure of structural details. Roemer figured the best but not the largest of his specimens [pl. 28] and the number of arms assigned by him to this species is 16. Stürtz finds this number also (14-16). At all events the species is large and its arms relatively numerous in contrast with other Paleozoic ophiurans. The disk is mostly covered by the converging arms and the length of any one of the latter from the point where it becomes free to its tip is almost equal to the axis of the disk which in both the German and American specimens seems not to be normally circular but often elliptical.

The New York specimens, *Helianthaster gyalum* nov. are smaller than *H. rhenanus*. The *arms* are more numerous and appear to be quite uniformly 24-25. Compared to *H. rhenanus* they are relatively short, but very long compared with the size of the disk which is much suppressed, and on none of the specimens, all showing the oral surface, is any distinct evidence of it visible, so deeply do the arms cut into it and so closely do they lie together. Notwithstanding this apparent retreat of the disk the *madreporiform plate* is very large. This organ is preserved in but one example and but here it overlaps two adjoining inter-brachial angles and the mouth parts pertaining thereto. Instead of being a flat or concave elongate plate as in *H. rhenanus* it is highly convex and circular; its surface markings less distinct and coarse than in that species.

The great *oral aperture* is margined by a series of pronounced "jaws" or sharp projecting elevated angles the sides of which take origin from the margins of adjoining arms. These oral projections are slightly expanded at their tips into blunt points comparable to but smaller than the "Höcker" of *H. rhenanus* but like these carry small spines projecting inward. The solidity and strength of these mouth parts is indicated by their prominence and elevation as shown in figure. It is probable that in this expression there is represented a combination of dorsal and ventral structure with the latter predominant by compression. Stürtz has been able to distinguish the dorsal and ventral details in *H. rhenanus* and assigns to the former a pair of divergent thickened crescentic narrow and vertical plates departing from the axis of each arm and each member joining one of the adjacent pair, thus producing the projecting oral processes. In our specimens it is not possible to discriminate these structures further than to recognize in them a combination of these oral plates with the spinous oral processes. The reentrant angle at the base of each arm is narrow, long and acute, much more extreme

in these respects than in *H. rhenanus* and very much more elevated.

In the structure of the arms there is essential agreement with that described for *H. rhenanus*. On the ventral aspect there are two rows of plates "in corresponding condition to each other, which never touch along the arm axis." Apparently in *H. gyalum* there is a slight tendency to alternation of opposite ventral plates as shown on the mold of these structures in the Ithaca specimen. The separation of these series of ventral plates is exhibited on the mold as a solid uninterrupted ridge representing a longitudinal slit. The lateral plates are well defined and bear several spines each, in contradistinction to the German species which is described as having but a single spine on each lateral.

A comparison of Stürtz's most complete individual of *H. rhenanus* and the specimen of *Helianthaster* from the Bundenschales obtained by me as that species, leads to the impression that they are not the same. The differences will be seen on examination of the figures here given of each. Stürtz's *H. rhenanus* has the free arms relatively very long, the disk correspondingly small, the reentrant angles of the disk heavily plated. The last named structures seem entirely absent on my specimen though the specimen presents a very clear oral surface; moreover the arms number 28 in contrast to the usual 14-16 of *H. rhenanus*, and both lateral and dorsal plates are enormously spinous. I think the differences are sufficiently distinctive to justify the designation of this species as *H. roemeri*.

FIELD MEETING OF AMERICAN GEOLOGISTS

The Geological section (E) of the American Association for the Advancement of Science held a summer field meeting at and near Plattsburg, N. Y., July 3-11, inclusive, to which all members of the Geological Society of America and the Association of American Geographers were invited. The itinerary for these meetings was planned and guided by members of the staff of this survey and as the excursions and addresses were most instructive and given under most favorable skies to a large company of geologists, an account of the proceedings, taken from the report of the secretary, Dr F. P. Gulliver [Science, Sept. 27, 1907] is inserted here.

The preliminary trip on July 3 was made to visit "The Gulf" at Covey hill. This drive of some 30 miles from Mooers, N. Y., across the Canadian boundary was exceedingly interesting to all students

Plate 12

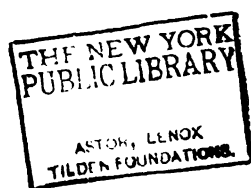


Helianthaster gyalum. A mold of one of the specimens showing the elevated "jaws" and the madreporiform plate

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of glacial geography. The marine and glacial shore lines were visited on the route westward from Mooers, and the party stopped for lunch in "The Gulf," near the two lakes which show the location of the gorge that represents the ancestor of Niagara. The noon talk, given by J. B. Woodworth, who has worked out the glacial history of this region, was on

Abandoned shore lines

At "The Gulf" Professor Woodworth spoke in substance as follows: "The Gulf" and Covey hill north of it constitute a locality of critical importance in the study of water levels in the Champlain and St Lawrence valleys. "The Gulf" pertains to the closing stages of the great ice-dammed lakes which formed in front of the ice in its retreat from the territory of the United States. When "The Gulf" was being excavated by a powerful torrent of water, the ice sheet still hugged the northern side of Covey hill, itself the northernmost spur of the Adirondacks.

The waters which entered "The Gulf" came from the west, the region of Lake Iroquois, whose waters would have taken this path after the ice retreat offered a lower outlet than that at Rome. The waters passed from "The Gulf" into Lake Vermont, the preglacial lake occupying the valley of the present Lake Champlain. Lake Vermont could not at this stage of its existence have risen above the surface of the water in the waterfall pools of "The Gulf." The lower lake is now 645 feet above sea level. The sea could not at this latitude have stood higher than the bottom of "The Gulf."

With the further retreat of the ice from the northern slope of Covey hill the water, which had previously discharged through "The Gulf" on the south side of the hill, flowed around the northern slope of the hill and emptied into the sea. The salt water came in, and the history of the great glacial lake was completed.

Signs of wave action occur on the Champlain side of the Adirondacks as high as 720 feet, but these higher water levels do not continue about the northern side of Covey hill north of "The Gulf." A good beach is continuous from the Champlain valley about Covey hill into the upper St Lawrence valley with an altitude of 450 feet at Covey hill. Higher signs of probable wave action occur up to 570 feet, merging into beaches evidently made by torrential waters confined between the hillside and the retreating ice front.

"The Gulf" was properly understood by Ebenezer Emmons to have been made by a powerful torrent flowing where now no stream

can flow. Gilbert, with the knowledge of the glacial theory, sought for a torrent spillway along the retreating ice sheet, and considered "The Gulf" the outlet for the glacial waters. "The Gulf" therefore is an integral part of the wonderful story of the great glacial lakes, and the political chance which has drawn the boundary line between Canada and the United States across "The Gulf" serves doubly to remind us of its living type, the gorge of Niagara.

On Thursday, July 4, those who had taken the preliminary trip to Covey hill drove from Mooers southward to West Chazy along many abandoned shore lines, at elevations varying from 300 to 600 feet above the present sea level. At West Chazy others joined the party from Plattsburg, and all met on Cobblestone hill, where a halt was made for an hour to study the remarkable beaches of cobbles showing pronounced bars, spits and hooks, at levels of 600 feet and over above sea level.

These beaches of heavy glacial detritus were laid down in a fresh-water glacial lake, when the ice stood a short distance north of this point, by the waters discharging from the northwest over Flat Rock from the Altona spillway.

Thence the party drove across the bare Potsdam sandstone over the Altona spillway, where striking evidences were seen of the scouring action of torrential glacial waters. After lunch at a spring of water running from the Potsdam sandstone in the spillway the party listened to a talk by Prof. H. L. Fairchild on

Lake Iroquois extinction

Lake Iroquois was the great glacial water held in the Ontario basin while the Laurentian ice mass occupied the St Lawrence valley and forced the overflow by the Rome outlet to the Mohawk and Hudson valleys. This original Iroquois outlet was effective for several thousand years, and determined the water level for nearly the whole existence of the glacial waters.

When the ice body weakened, and the front receded on the salient which projects northeastward from the Adirondacks into Canada, a lower escape for the ice-dammed waters was opened across the Covey hill ridge, precisely at the International boundary.

"The Gulf," as it is locally known, is a great cut in Potsdam sandstone, long since noted by Emmons and Gilbert, and recently described by Woodworth. The present altitude of the head of the Covey outlet is over 900 feet, but at the time it was opened the locality was about 460 feet lower than today, and the initiation of

Plate 14



Beach, north slope of Covey Hill, Canada

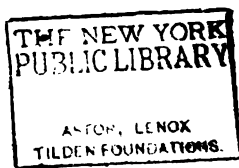
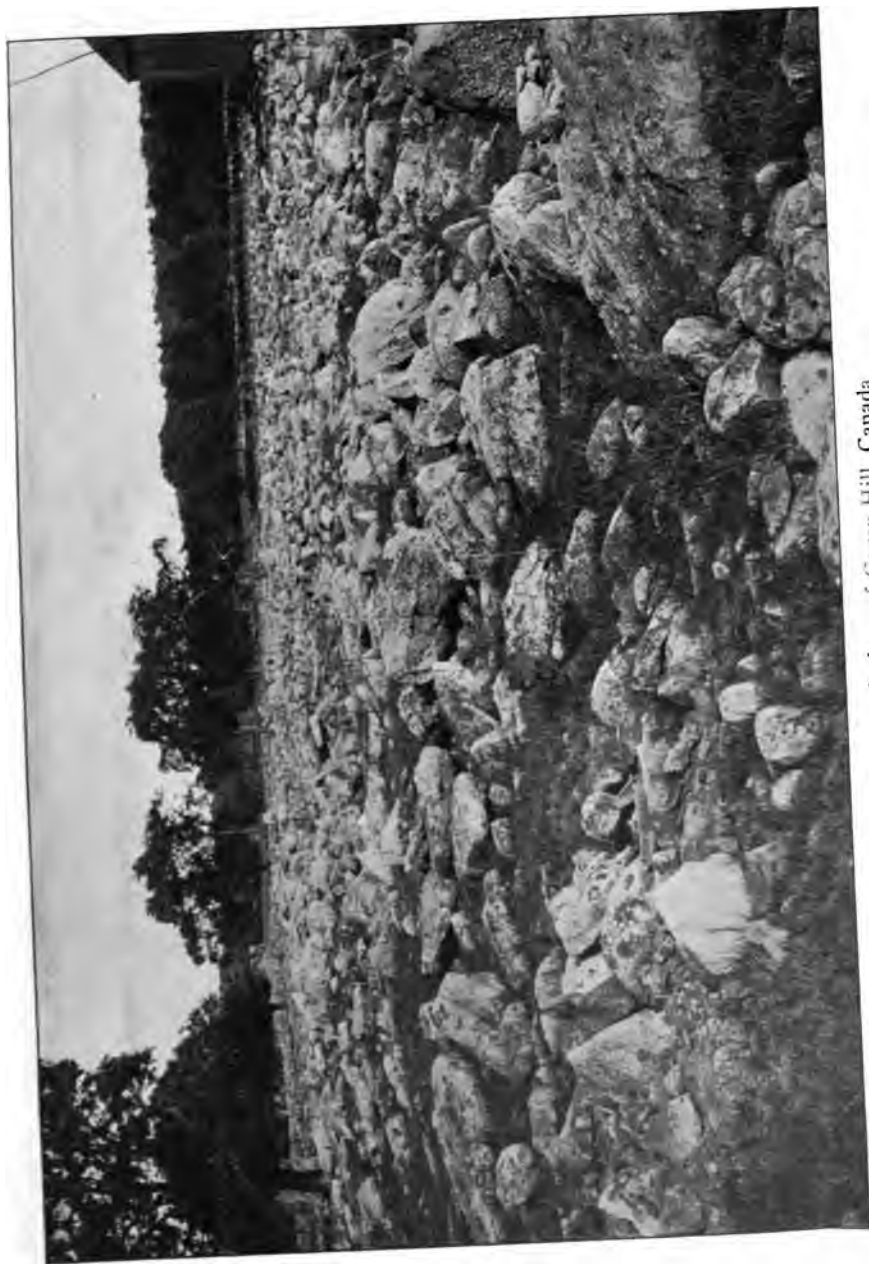


Plate 15

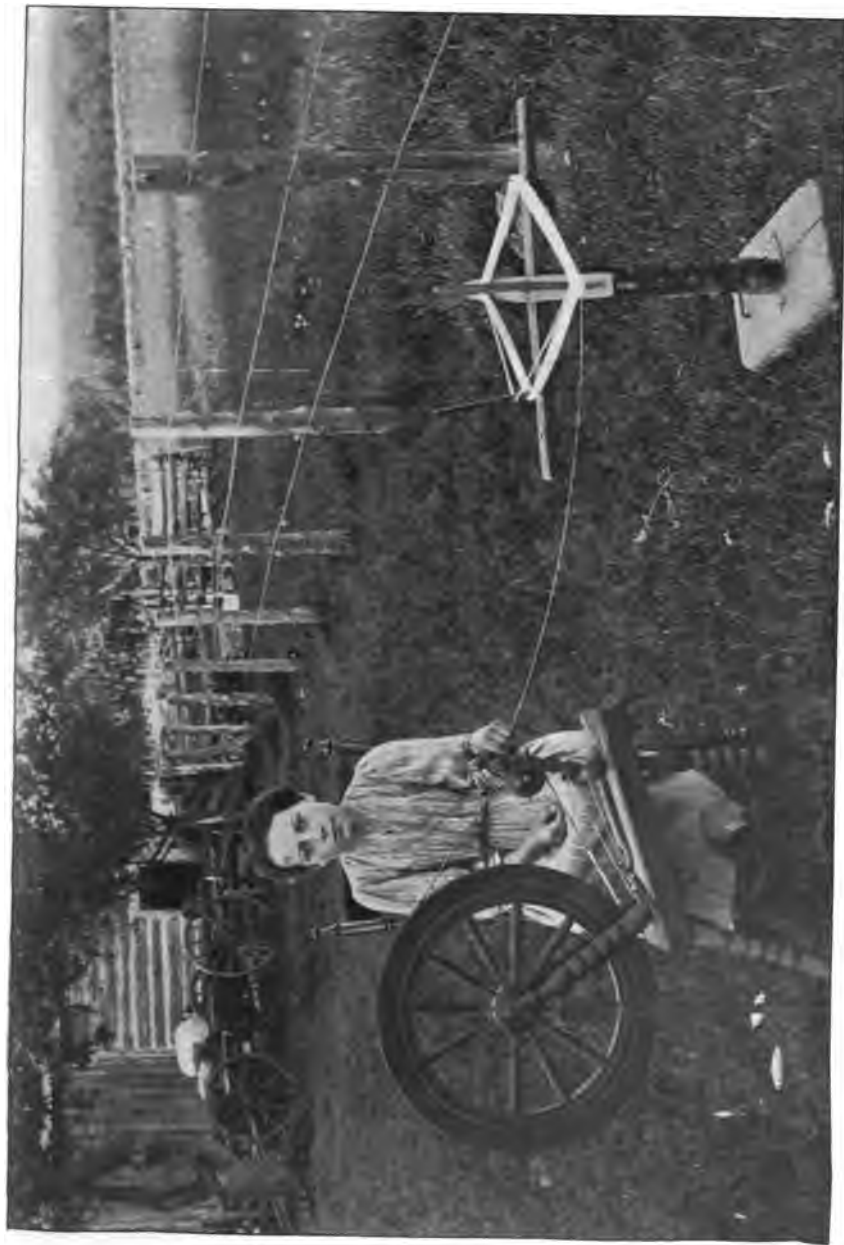


Beach, north slope of Covey Hill, Canada

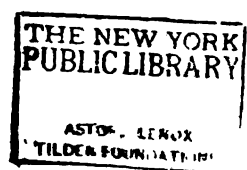
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Plate 16



Covey Hill, Canada



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Plate 17



Curved end of bar, Cobblestone hill, Altona, N. Y.

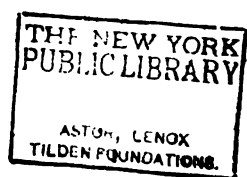
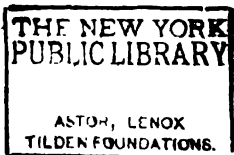


Plate 18



Cobblestone hill Altona, N. Y., Professor C. H. Hitchcock in picture



the river flow must have been inferior to the Rome level, which is now 440 feet.

After at least many centuries of flow this predecessor of the St Lawrence river, carrying the overflow of the second stage of Iroquois waters (or Hypo-Iroquois), was extinguished by the ice recession opening a yet lower pass, on the north slope of Covey hill. This third phase of the Iroquois waters was short-lived and of rapidly falling levels, the river flow past the ice front only terracing the sandstone slope.

When the waters were lowered about 450 feet below the Gulf channel, they became confluent with the oceanic waters, and the Ontario basin was occupied by the Gilbert gulf, a branch of the Champlain or Hochelagan sea.

On Friday the parties from Mooers and Plattsburg met at Chazy where Professor Cushing and Dr Ruedemann showed the visiting geologists many interesting features of the Chazy limestone, the local succession of beds, the characteristic fossils, the faults, and the dissection which have produced the present topography. After supper, while waiting for the train to Plattsburg, the party sat on the hotel porch and listened to a talk by Dr. R. Ruedemann on

The Lower Siluric paleogeography of the Champlain basin

The relations of the faunas of the Beekmantown, Fort Cassin, Chazy, Black River, Trenton, and Utica beds to those of the Atlantic and Pacific basins and the Mississippian sea were discussed, and by means of these relations the probable marine connections of the Chazy basin and the Levis channel with the oceanic basins traced. It was suggested that the Beekmantown sea, while extending as far as the Newfoundland embayment, held an American epicontinental fauna; that the Fort Cassin fauna did not reach Canada, but flourished in the Appalachian trough to the south of the Chazy basin, and also spread westward into the epicontinental sea. The typical Chazy fauna is thus far recorded only for the Chazy basin and the southern Appalachian trough. It extended as far as the Mingan islands, and came probably from the Atlantic basin. There is also evidence that it had some connection with the American epicontinental sea.

The Black River and Trenton faunas, while largely American in their aspects, contain European species as the first of the Lower Siluric; and the connection of the Trenton sea with the Atlantic ocean can not be doubted. In Utica time the channel became so

wide that an oceanic current could enter the epicontinental sea from the northwest, bringing with it new faunal elements, and spreading mud shales over a large area of eastern North America.

The evidence of a deeper sea in the Levis channel, furnished by the series of Lower Siluric graptolite shales, was also presented, and the relations of the graptolite shales to the mobile parts of the earth crust, the geosynclines, briefly mentioned.

Friday evening the party went to Cliff Haven, 3 miles south of Plattsburg, where the authorities of the Champlain Assembly had placed at the disposal of Section E the New York cottage, in which the party were delightfully housed for five days. Excursions were made each day to various points, and in the evening all returned to the broad piazzas of the cottage, where they sat and discussed the various trips, within a few feet of one of the striking fault-line scarps of the region, looking out over the waters of Lake Champlain.

On Saturday morning, July 6, the party gathered on the steam launch kindly furnished by the State of New York, and under the guidance of Professor Cushing, Dr Ruedemann and Professor Hudson, took a charming sail on Lake Champlain. The party visited Crab and Valcour islands and studied the Paleozoic sediments which are there so beautifully exposed with their many interesting structural features.

At noon the party enjoyed the delightful hospitality of Prof. and Mrs George H. Hudson of Plattsburg at their charming camp on Valcour island. After lunch a talk was given by John M. Clarke on

Lake Champlain

Dr Clarke spoke of the origin of the Lake Champlain valley as the result of a series of downthrown fault blocks having the evident aspect of a *graben*. He referred to the later evidence as confirmatory of Logan's conception of the Lake Champlain fault and indicated that this origin was borne out by the present attitude of the downthrown Paleozoics against the abrupt eastern scarps of the Adirondack crystalline shield.

Reference was also made by the speaker to the possibility that the geographical name Trembleau, which designates the prominent headland and mountain ridge just south of Port Kent, embodies the record of an ancient seismic disturbance, and with this as a text fuller reference was made to the Canadian earthquake of 1663

Plate 19



Cuspate foreland, Valcour, N. Y.

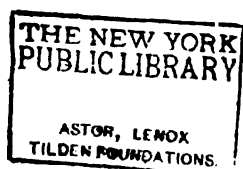
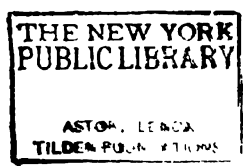


Plate 20



Maclurea magna, Chazy, N. Y.



which appears from the records preserved in contemporary documents to be the severest disturbance this continent has ever suffered from terrestrial dislocations. This earthquake was evidently a movement of the Paleozoics against the crystalline shield along the course of the St Lawrence river or the St Lawrence fault, and its destructive effects from Montreal down to Tadousac were tremendous. It seemed to the speaker quite reasonable to infer that this displacement must have been continued along the contact line of the Paleozoics and the crystallines in the direction of the Champlain fault, although the historic records for this region are very meager.

After lunch the party divided, one portion spending the afternoon on the shores of Valcour island studying stratigraphy and paleontology. The others sailed southward to the delta of Ausable river, where a landing was made and photographs taken showing some of the recent shore-line changes. Thence this party sailed across the lake between Stave and Providence islands, and then northward along the Vermont shore, returning to Cliff Haven.

In the evening in the auditorium of the Catholic Summer School the one formal gathering of the Plattsburg meeting took place. The Rev. John Talbot Smith LL.D., president of the summer school, welcomed the geologists in the name of the authorities of Champlain Assembly and introduced the vice president of Section E, Dr Alfred C. Lane, who gave his vice presidential address on the "Early Surroundings of Life."

Prof. B. K. Emerson thanked the authorities of the Champlain Assembly for their hospitable reception of Section E.

On Sunday various features of the local geology were visited by members of the section. Others attended services at the chapel on the grounds.

At noon the party were entertained most delightfully by the Hon. Smith M. Weed and his family at his summer home on the shores of Lake Champlain. In the afternoon another sail was taken in a steam launch on Lake Champlain.

In the evening Prof. George H. Hudson, of the Plattsburg Normal School, showed the laboratories and some of the work of his students. The members then met in the science classroom, and listened to an informal talk by Professor Hudson on "Blastoidocrinus and its Type," illustrated by 50 lantern slides. The slides of Billings's type were from negatives possessing an amplification of 10 diameters, and showed in a remarkable manner many points of structure

not before noted in the specimen. The outer folds of the hydrospires were seen to extend under the interbranchials to the edges of the bibrachials. The position of the stem was shown to be not normal, as Billings supposed, but thrust up into the coelomic cavity and separating the basals from the radials. There were no features to show a specific difference between the Canadian type and the more perfect Valcour island specimen, but the type served to corroborate in a clear manner much of the detail worked out from the latter and published in Bulletin 107 of the New York State Museum.

On Monday, July 8, the party went by train from Plattsburg to Lyon Mountain, and spent the day studying the magnetite mines under the guidance of Mr Newland. After lunch the section listened to a paper by D. H. Newland on

The iron ores of the Adirondack region

Four varieties of iron ores are found within the limits of the Adirondack region, each constituting a more or less independent class of deposits as regards geological associations and mode of origin. The varieties are as follows: (1) nontitaniferous magnetites, (2) titaniferous magnetites, (3) hematites, (4) limonites. In respect to the relative age or period of formation, it is probable that the magnetites of class 1 are the oldest, since they antedate the metamorphism and structural disturbances that affected the region during Precambrian times. The titaniferous ores were formed before the oldest of the fossiliferous rocks of the region (the Potsdam sandstone) was deposited, and are generally regarded to be contemporaneous with the igneous inclusions in which they occur. The hematite ores are probably later than the Potsdam; while the limonites have the character of bog ores and are relatively recent surface concentrations.

The nontitaniferous magnetites are the most widespread of all the ores in their geographical distribution, and have been in the past and still are the main source of supply for the region. In a strict sense they are hardly deserving of the name that has been applied to them by geologists, since they nearly always carry titanium, though the amount is small, usually but a fraction of one per cent. These ores are found in all parts of the Adirondacks, except the central which is occupied by the great gabbro-anorthosite mass. They are associated with different members of the Precambrian crystalline series including gneisses of igneous derivation with the mineralogy of granites and syenites, with gneisses of doubtful re-

lationships, and with the schists and limestones of the sedimentary (Grenville) type. Their origin is obscure, a problem that has been fruitful in discussion and theorizing among geologists. It is doubtful if any one of the explanations that have been advanced is satisfactory as a general basis for the whole group; rather it would seem that the varying conditions surrounding the character and associations of the deposits indicate that they have been formed by a complexity of processes which may have differed materially in individual cases.

The titaniferous magnetites are distinguished from those of the preceding group by their higher percentage of titanium, which ranges from about 3 or 4 per cent, as a minimum up to a maximum of 10 or 15 per cent, and by the fact that they are always inclosed by basic igneous rocks of the gabbro family. They have been described by Prof. J. F. Kemp as basic segregations formed during the cooling and consolidation of the wall rocks, an explanation that is generally regarded as correct. Some of the largest deposits of iron ores in the region belong to this class, those of Lake Sanford being specially extensive. After a long period of inactivity, due to the difficulties encountered in smelting the ores in the blast furnaces, attention is now being directed to the deposits with a view to their utilization. It has been found that the ores in some cases at least are not simply magnetite carrying titanium uniformly through its mass, but that they consist of a mixture of magnetite and ilmenite, the former having almost no titanium, a condition that is favorable to their commercial treatment.

The hematite ores are practically limited to the western Adirondack region of St Lawrence and Jefferson counties. In this area the Grenville schists and limestones attain wide development, forming an interbedded series which has been upturned and sharply folded. Granite intrusions are numerous, but there is a noticeable lack of the basic igneous rocks that occur abundantly in the central and eastern Adirondacks. The ore bodies consist of lenticular, tabular, or irregular masses inclosed within belts of the schist and limestone, or lying along the contact of these rocks as at the Caledonia mine. Stringers and larger bands of ore often extend out from the main bodies for considerable distances into the foot and hanging walls. The deposits have originated, without much doubt, by a process of replacement. They grade at the borders into the wall rock and frequently inclusions may be found that show complete transition from the rock to the ore. Where the walls are

schist, the ore often preserves the appearance of banding and cleavage, and not uncommonly carries a small percentage of graphite, the only mineral that seems to have successfully resisted the solvent action of the iron-bearing solutions.

As to the source from which the iron has come, the explanation advanced by C. H. Smyth jr, merits full acceptance since it meets the conditions surrounding the geology of the deposits. His theory is that the iron has been derived from pyrite and magnetite, which occur abundantly in the schist in the immediate vicinity of the ore bodies. By oxidation the pyrite would yield ferrous and ferric sulfates, which would be readily taken up by the underground circulations. Free sulfuric acid would also result and react upon the veins and disseminations of magnetite. By reaction with the limestone and the minerals of the schist, the solutions would decompose and the iron precipitate as carbonate and limonite. By subsequent alteration these minerals have been changed to hematite. Residual masses of carbonate are occasionally found in the deposits. Whenever the Potsdam sandstone is found in contact with the ore, the lower layers show a deep iron stain, evidently the effect of impregnation by the iron-bearing solutions.

The fourth class of iron ores, the limonites, are not of much importance in the Adirondack region. The deposits are, as already stated, superficial accumulations due to the washing and leaching of the neighboring rocks and soils. They seldom, if ever, exist of sufficient size and richness to repay working, at least under present conditions.

On Tuesday an excursion to Keeseville and the Ausable chasm was made by train and trolley. Professors Woodworth and Cushing showed the party the marine delta of the Ausable river, the former lake shore lines, the post-Hochelagan gorge of the Ausable river cut in Potsdam sandstone, the Potsdam conglomerate, the northern slope of Trembleau mountain, and the anorthosite.

In the evening at the Champlain Club Prof. H. P. Cushing discussed the

Evidences of physical oscillations during the Cambro-Silurian in northeastern New York

as brought out by a general study of the stratigraphy of the region. There was a great Potsdam subsidence on the northeast, diminishing to zero westward. The succeeding Beckmantown depression encroached further on the land than did the Potsdam on the southern

margin of the region, but like that was greatest on the northeast. During the Beekmantown occurred an uplift which caused cessation of deposition in all the region except the eastern border, confining the later Beekmantown and the Chazy deposits to that district. Oscillation then occurred between the Beekmantown and the Chazy, pinching out the Chazy to the south. Depression then ensued on the south and west, and the Lowville beds were deposited. The Black River limestone followed, this being the first formation found on all three sides of the region, which indicates connecting waters and similar conditions on these sides.

In the following Trenton time it seems likely that the waters nearly overspread the entire present Adirondack region, though shore-line conditions and small subsidence are characteristic of the Mohawk valley region.

Utica shale conditions came in from the east, and gradually encroached westward on the Trenton, so that the one thickens as the other thins, the Trenton thickest on the west, the Utica on the east. Following the Utica came the uplift which brought most of the region above sea level.

On Wednesday, July 10, the party regretfully bade goodbye to the hospitable authorities of the Catholic Summer School, and took the delightful sail down Lake Champlain.

At Baldwins, the steamboat terminal at the northern end of Lake George, the party were met by Prof. J. F. Kemp, by whom they were guided in the Lake George valley. The first stop was Hague, where the graphite bed at the Lakeside mine was studied. The bed is 10 feet thick, and consists of a graphite schist in which graphite supplies the micaceous mineral. Feldspar, quartz and a little pyrite constitute the associated minerals. In physical aspect the beds appear but slightly changed from a shaly sandstone. The floor and roof rocks are a garnet-feldspar gneiss with much sillimanite. The pegmatitic phases are frequent. The several methods of origin, organic; hydrocarbons akin to petroleum; the influence of eruptive rocks, etc., were passed in review. The forms of occurrence of graphite in the Adirondacks, in crystalline limestones, pegmatite veins, and schists or quartzites were set forth. The invariable association even of the graphite-bearing pegmatites with Grenville sediments was emphasized, and the schists seemed most probably a metamorphosed carbonaceous sediment, or one which had been impregnated with a heavy oil.

The party next visited the potholes on Indian Kettles point, 2 miles north of Hague. These interesting relics of the glacial epoch are on a rocky point, and 15 feet or more above the present lake.

In the evening a brief exposition of the local geology and physiography was given by J. F. Kemp, and illustrated by manuscript maps. The sediments of the Grenville series are the oldest rocks, now greatly metamorphosed. A syenitic series of eruptives, the most extensive of the local formations, succeeded the Grenville, and these are also greatly metamorphosed. There are also rocks intermediate between syenite and gabbro; true gabbros and granites. Lastly came a few basaltic dikes. There are no late Paleozoics in the region, but the Potsdam and Beekmantown are near or in the Lake George basin. The physiography was believed by the speaker to be chiefly due to block faulting, which was freshened up by the ice-sculpturing of the glacial epoch.

The next morning the party proceeded to Hulets, and visited an igneous contact on Tafts point. At Hulets dock interesting pegmatites and the effects of shearing and faulting were seen. Three sets of displacement could be detected. The party were kindly taken about the lake by Dr Smith Ely Jelffe in his launch, adding greatly to their pleasure and profit. After lunch in the charming summer home of Professor and Mrs Kemp the members continued south through the lake and dispersed.

III

REPORT OF THE STATE BOTANIST

The State Botanist reports that the interval between the collecting seasons of 1906 and 1907 was devoted to office work which consists of the examination and identification as far as possible of unidentified collected material and the accumulated contributed material, the preparation of the annual report and the incorporation of the new material in the herbarium. The field work has been principally a continuation of the investigation and collection of specimens of the Crataegus flora and mycological flora. Of the former, considerable collections have been made in two specially prolific localities, one near Corning, Steuben co., the other near Clayton, Jefferson co. Collections here were made both in the flowering and in the fruiting period of these plants. The identification of much of this material has not yet been made,

The season of 1907 has been singularly like that of 1906 in its unfavorable influence on the mushroom crop. Frequent rains with prevailing low temperature occurred early in the season. These were followed by a long period of dry weather which was exceedingly unfavorable to mushroom growth. Notwithstanding these adverse conditions about 25 species of fungi have been added to the list of already known New York species. Of these, seven appear to be new or undescribed. In addition to these, eight species of flowering plants have been added to the State flora, but four of these are introduced plants. One alga, one hepatic moss and 10 lichens are among the additions to the flora. Most of these additions are due to the interest and activity of correspondents. Specimens of plants of various kinds, representing 125 species not new to the herbarium, have been collected. These serve to illustrate better and more completely the range and variation of their respective species. A list of the names of these and of those new to the herbarium accompanies this report.

Tests have been made of the edibility of several species of mushrooms. Eight of these have been approved and added to the list of edible fungi of New York, bringing the whole number up to 191. Descriptions and colored figures of these will be given in accordance with the plan recently followed.

In answer to requests for information concerning plants either personally or by letter, 891 identifications of species have been made for 86 applicants.

Stewart H. Burnham, assistant, has disinfected the collections of 1906 which needed such treatment, labeled and arranged them in their proper places, assisted in conducting the correspondence of the office, in the identification of specimens and in giving to inquirers the desired information concerning them. He has continued the work on a card catalogue of the fungi described by the State Botanist and prepared a list of these for publication.

Species added to the herbarium

New to the herbarium

<i>Ajuga reptans</i> L.	<i>Clitopilus subplanus</i> Pk.
<i>Biatora prasina</i> Fr.	<i>Crataegus anomala</i> Sarg.
<i>Biatorella simplex</i> (Dav.) B. & R.	<i>C. plana</i> Sarg.
<i>Boletus niveus</i> Fr.	<i>C. suborbiculata</i> Sarg.
<i>Centaurea solstitialis</i> L.	<i>Cronartium ribicola</i> Dietr.
<i>Cetraria glauca</i> (L.) Ach.	<i>Diaporthe parasitica</i> Murr.
<i>Chaetomium sphaerospermum</i> C. & E.	<i>Flammula pulchrifolia</i> Pk.
<i>Cladonia bacillaris</i> (Del.) Nyl.	<i>Galium erectum</i> Huds.
<i>Clitocybe subcyathiformis</i> Pk.	<i>Hygrophorus coloratus</i> Pk.

H. lacmus Fr.
Hypocrea polyporoidea B. & C.
Lactarius minuscule Burl.
Leaia piperata Banker
Lecidea platycarpa Ach.
Lophiotrema semiliberum (Desm.)
Lotus corniculatus L.
Metzgeria conjugata Lindb.
Monilia crataegi Diedicke
Myxosporium necans Pk.
Nolanea suaveolens Pk.
Parmelia cetrata Ach.
P. perforata (Jacq.) Ach.

Pholiota duroides Pk.
Physcia hypoleuca (Muhl.) Tuck.
Polyporus spraguei B. & C.
Polystictus montagnei Fr.
Rinodina oreina (Ach.) Mass.
Russula aeruginea Fr.
Sphaeropsis lyndonvillae Sacc.
S. persicae E. & B.
Stereocaulon coralloides Fr.
Stropharia bilamellata Pk.
Trentepohlia umbrina (Kütz.) Born.
Tubercularia davisiana Sacc.
Viola vagula Greene

Not new to the herbarium

Accidium clematidis DC.
Ae. grossulariae (Gmel.) Schum.
Agaricus arvensis Schaeff.
Alsine longifolia (Muhl.) Britton
Amanita caesarea Scop.
A. formosa G. & R.
A. phalloides Fr.
A. rubescens Fr.
Amanitopsis farinosa Schw.
A. vaginata (Bull.) Rose
Aronia nigra (Willd.) Britton
Aster divaricatus L.
A. panic. bellidiflorus (Willd.)
Blitum capitatum L.
Boletus albocarneus Pk.
B. castaneus Bull.
B. chromapes Frost
B. clintonianus Pk.
B. elbensis Pk.
B. nebulosus Pk.
B. ravenclii B. & C.
B. subaureus Pk.
B. subtomentosus L.
Calvatia elata (Mass.) Morg.
Cantharellus cibarius Fr.
C. cinnabarinus Schw.
C. floccosus Schw.
C. minor Pk.
Carya amara Nutt.
C. glabra odorata (Sarg.)
Castanea dentata Borkh.
Chrysanthemum leucanthemum L.
Clitocybe amethystina (Bolt.)
C. candicans Fr.
C. laccata (Scop.) Fr.
Clitopilus caespitosus Pk.
Collybia acervata Fr.
C. dryophila (Bull.) Fr.
C. lacunosa Pk.
C. platyphylla Fr.
Conringia orientalis (L.) Dum.
Cortinarius torvus Fr.
Crataegus bissellii Sarg.
C. uniflora Moench.
Cypripedium arietinum R. Br.
Cystopus amaranthi Berk.

Dasystoma virginica (L.) Britton
Deconica bullacea Bull.
Dryopteris goldieana (Hook.) Gray
Eleocharis ovata (Roth) R. & S.
Erysimum cheiranthoides L.
Erysiphe polygoni DC.
Euphorbia polygonifolia L.
Flammula lubrica Fr.
Fraxinus lanceolata Borkh.
F. pennsylvanica Marsh.
Fuligo ovata (Schaeff.) Macb.
Fusisporium destruens Pk.
Galium mollugo L.
Habenaria blephariglottis (Willd.)
H. ciliaris (L.) R. Br.
Helotium citrinum (Hedw.) Fr.
Helvella infula Schaeff.
Hydnum fennicum Karst.
H. septentrionale Fr.
Hygrophorus borealis Pk.
H. ceraceus Fr.
H. coccineus (Schaeff.)
H. marginatus Pk.
H. pratensis (Pers.) Fr.
Hypholoma candolleianum Fr.
H. capnoides Fr.
H. incertum Pk.
H. subaquilum Banning
H. sublateralitium (Schaeff.)
Lactarius camphoratus Fr.
L. insulsus Fr.
L. oculatus (Pk.) Burl.
L. subdulcis Fr.
L. varius Pk.
Lentinus spretus Pk.
Lenzites separia Fr.
Lepiota acerina Pk.
Lycoperdon gemmatum Batsch
L. glabellum Pk.
L. subincarnatum Pk.
Marasmius glabellus Pk.
M. minutus Pk.
M. subnudus (Ellis) Pk.
Mycena rosella Fr.
Panus torulosus Fr.
Paxillus involutus Batsch

Phlebia radiata Fr.
Pholiota aggericola Pk.
P. caperata Fr.
P. discolor Pk.
P. praecox Pers.
Polyporus adustus Willd.
P. betulinus Fr.
P. caesius Fr.
P. cuticularis (Bull.) Fr.
Polystictus biformis Klotz
P. pergamenus Fr.
Psilocybe conissans Pk.
Puccinia andropogonis Schw.
P. coronata Cd.
Russula crustosa Pk.

R. decolorans Fr.
R. emetica Fr.
R. fallax Fr.
R. obscura Rom.
R. ochrophylla Pk.
R. pectinatoides Pk.
R. squalida Pk.
R. uncialis Pk.
R. variata Banning
R. virescens Schaeff.
Salix serissima (Bail.) Fern.
Thelephora palmata (Scop.) Fr.
Tricholoma personatum Fr.
T. vaccinum Pers.

Trees represented by trunk sections in the State Museum collection

Abies balsamea (L.) Mill.
Acer pennsylvanicum L.
A. rubrum L.
A. saccharum Marsh.
A. saccharinum L.
A. rubrum L. (curly grain)
Aesculus hippocastanum L.
Ailanthus glandulosus Desf.
Alnus incana (L.) Willd.
Amelanchier canadensis T. & G.
Aralia spinosa L.
Betula lenta L.
B. lutea Michx.
B. nigra L.
B. papyrifera Marsh.
B. populifolia Marsh.
B. papyrifera Marsh. (unblackened bark)
Carpinus caroliniana Walt.
Carya alba Nutt.
C. amara Nutt.
C. microcarpa Nutt.
C. porcina Nutt.
C. sulcata Nutt.
Castanea dentata (Marsh.) Borkh.
Celtis occidentalis L.
Cornus florida L.
Chamaecyparis thyoides (L.) B.S.P.
Crataegus punctata Jacq.
C. crus-galli L.
Diospyros virginiana L.
Fagus americana Sweet
Fraxinus americana L.
F. nigra Marsh.
F. pennsylvanica Marsh.
Gymnocladus dioica Koch
Juglans cinerea L.
J. nigra L.
Juniperus virginiana L.
Larix americana Michx.
Liquidambar styraciflua L.
Liriodendron tulipifera L.

Magnolia acuminata L.
Morus rubra L.
Nyssa sylvatica Marsh.
Ostrya virginiana (Mill.) Koch
Picea rubens Sarg.
Pinus echinata Mill.
P. resinosa Ait.
P. rigida Mill.
P. strobus L.
Platanus occidentalis L.
Populus candicans Ait.
P. deltoides Marsh.
P. dilatata Ait.
P. grandidentata Michx.
P. heterophylla L.
P. tremuloides Michx.
Prunus avium L.
P. pennsylvanica L.f.
P. serotina Ehrh.
Quercus acuminata (Michx.) Houda
Q. alba L.
Q. coccinea Muench.
Q. marilandica Muench.
Q. minor (Marsh.) Sarg.
Q. palustris Muench.
Q. platanoidea (Lam.) Sudw.
Q. prinus L.
Q. rubra L.
Q. velutina Lam.
Rhus typhina L.
Robinia pseudacacia L.
Salix amygdaloides Anders.
S. nigra Marsh.
Sassafras officinale N. & E.
Thuja occidentalis L.
Tilia americana L.
Tsuga canadensis (L.) Carr.
Ulmus americana L.
U. fulva Michx.
U. racemosa Thomas
Viburnum lentago L.

Species still unrepresented

<i>Acer negundo</i> L.	<i>Pinus divaricata</i> (Ait.) Sudw.
<i>A. nigrum</i> Michx.	<i>P. virginiana</i> Mill.
<i>Carya tomentosa</i> Nutt.	<i>Populus balsamifera</i> L.
<i>Fraxinus lanceolata</i> Borck.	<i>Quercus macrocarpa</i> Michx.
<i>Gleditsia triacanthos</i> L.	<i>Tilia heterophylla</i> Vent.
<i>Picea canadensis</i> (Mill.) B. S. P.	<i>T. michauxii</i> Nutt.
<i>P. mariana</i> (Mill.) B. S. P.	

IV

REPORT OF THE STATE ENTOMOLOGIST

The State Entomologist reports that the climatic conditions of 1907 have departed widely from those of normal years and, as a result the development of animal and plant life was exceptionally late. Warm weather finally came on very rapidly and all vegetation grew at such a rate that insects appeared unable to inflict material damage in many cases, consequently there has been an unusual dearth of injurious outbreaks, particularly in the early part of the year, and presumably due largely to this cause. An exceptional event was the capture by Dr Theodore P. Bailey of this city, of two specimens of the exceedingly rare *Leucobrephos brephigides* Walk; the specimens were taken the last of April in St Lawrence county and deposited in the State Museum.

Fruit tree insects. The *San José scale* is one of the most serious insect enemies of the horticulturist. The spread of earlier years has continued, and in places where very little effort has been made to check its ravages, the scale has become extremely abundant and in some instances at least, has practically ruined the crop. Our experiments of earlier years show very clearly that a lime-sulfur wash is thoroughly effective in destroying the scale as well as beneficial in checking certain other insect pests and fungous diseases. We have steadfastly insisted that it was wiser to use some such material than to employ the more easily applied mineral oils or preparations of the same, known as "soluble oils," because the latter under certain conditions may seriously injure the trees. This has been done in the face of a determined effort by interested parties to introduce oils and oil preparations as the most available remedies for San José scale. Despite the fact that these last named materials are valuable under some conditions, it remains true that we must still rely in large measure upon the lime-sulfur wash for the control of this pest. Our conservative recommendations, we believe, have deterred many from seriously injuring valuable orchards by making injudicious use of the more dangerous oil preparations.

The operations of the *grape root worm* in the Chautauqua region have been observed during the season and, in our judgment, there is a marked improvement over the conditions of earlier years. This change is partly due to the higher price of grapes and the consequent better care and fertilization given the vineyards, though it is probable that natural conditions have been of material service in reducing the numbers of this pest. It is still true that this enemy is abundant in limited areas, and danger of serious injury to vineyards here and there is by no means past.

Shade tree protection. Continued devastations by several shade tree pests have necessitated the giving of considerable attention to this phase of economic entomology. A bulletin on the *white marked tussock moth* and the *elm leaf beetle*, our two most injurious species, was issued in May and a number of warning articles sent to the press throughout the State. The general result has been highly beneficial and much interest has been aroused. The agitation of earlier years secured the appointment of a forester by the city of Albany. This official was placed in charge of the trees, and the spraying with poison resulted in marked benefit, despite the hindrances incident to work of that character. The city of Troy, through municipal agencies, accomplished considerable along this line. Before very long a number of other cities will be compelled, by the severity of insect depredations, to adopt some protective measures or lose many valuable trees. The experience of the last decade has demonstrated beyond all question the possibility of protecting our trees from injuries by such leaf feeders as the elm leaf beetle and the white marked tussock moth. It is practical to spray the trees so thoroughly that even in localities where the elm leaf beetle and the tussock moth caterpillars are rather abundant, there will be no serious injury to the foliage, and those interested in this work should insist upon the maintenance of such a standard.

Gipsy and brown tail moths. The work of last year in watching for the appearance of these insects within the borders of New York State, has been continued. Many caterpillars of various species, all native, however, have been sent in by different correspondents, some fearing that they had found one or the other of these pests. These fears, we are pleased to state, were groundless and, so far as known to us at the present time, neither of these species has obtained a foothold within our boundaries.

Several days in June were spent in the New England territory infested by these species, investigating in particular the recently

undertaken work of destruction by means of parasites. Thousands of these beneficial parasites have been brought into this country, taken to the laboratory at Saugus, reared to maturity, the dangerous hyperparasites destroyed and the beneficial forms liberated under conditions favorable to their multiplication. Our investigations showed that certain of these European enemies had survived the winter and that there is at least a fair prospect of considerable benefit resulting from this systematic importation of natural enemies. The general situation is distinctly more encouraging than was the case last year. A general campaign of repression has been conducted most vigorously and the beneficial result therefrom is easily seen in Boston and vicinity. Furthermore, the Federal Department of Agriculture is cooperating with the Massachusetts authorities in an effort to prevent the further spread of the gipsy moth in particular. This latter phase of the work consists largely in keeping all highways free from caterpillars, so as to make it impossible for automobiles to carry these leaf feeders into uninfested regions. The gipsy moth is being combated strenuously in Rhode Island and Connecticut and there is a very strong probability that the few insects in the last named state will be speedily exterminated.

Forest insects. There were two outbreaks the past season of exceptional interest. The striped maple worm, *Anisota rubicunda* Fabr. was very abundant on sugar maples in Berlin and Stephentown, Rensselaer co., stripping the leaves from large blocks of forest and proving injurious over hundreds of acres. The snow-white linden moth, *Ennomos subsignarius* Hübn. was extraordinarily abundant on beech trees in the Catskills, defoliating large areas in and about the township of Hardenburgh. Both of these outbreaks are unusual, as neither of these species has been injurious in New York State for some years. Detailed accounts of these insects have been prepared and will be published in the Entomologist's report.

Aquatic insects. The studies of our fresh-water insects have been continued. Dr James G. Needham has completed his report on the work done at Old Forge, N. Y. in 1905, and it will be published as an appendix to the Entomologist's report. The monograph on the Stone flies (Plecoptera) begun by Dr Needham several years ago, is nearly completed and will prove an addition to our knowledge of this group. Dr Cornelius Betten, who has been studying the Caddis flies (Trichoptera) for the past six years, has nearly completed his report upon these forms. The investigations of these

two gentlemen relate to a group which is of great economic importance owing to its value as fish food.

Gall midges. This group comprises among its members, several insects of prime economic importance, such as the Hessian fly, the wheat midge, pear midge and some other destructive forms. Furthermore, there is every probability that some other of our native species may become destructive in the near future. Our investigations have already disclosed hitherto unsuspected injuries by members of this group. We have succeeded in identifying several European forms not previously known to occur in this country. During the season we succeeded in rearing over 100 species, a considerable number of them proving to have been undescribed. The State collections in this group represent probably over 600 species. We have already described over 250 new forms, and it would not be surprising if, after working over the material, there were nearly as many more to characterize in addition to those previously described by other workers. The classification of the American species has been in a chaotic state, making it practically impossible to identify many of our forms. Our work, now well in hand, will revise the classification of this group.

The rearing of these insects requires much time and attention, and the success achieved last season was due very largely to the work of Assistant Entomologist D. R. Young. The collecting of the insects and the galls in the field also requires considerable time, and much of this work has been attended to by assistant I. L. Nixon. Mr J. R. Gillett was engaged throughout the summer in making microscopic mounts of these insects, some 2000 slides being prepared.

Publications. Numerous economic articles have been contributed by the Entomologist to the agricultural and local press. The large number of new species of Cecidomyiidae taken in 1907 made it advisable to issue preliminary descriptions of some, and a paper issued in advance of the report, entitled "New Species of Cecidomyiidae," published January 30, characterizes 179 new species. The second volume of *Insects Affecting Park and Woodland Trees*, New York State Museum memoir 8, appeared February 25 and has repeatedly proved its usefulness during the past season. The demand for information respecting shade tree pests led to the issuing of a special bulletin on the white marked tussock moth and elm leaf beetle, Museum bulletin 109, which appeared May 10, while the report of the Entomologist, owing to delays, was not issued till July 16.

Collections. The special collecting and rearing of Cecidomyiidae by members of the office staff, has resulted in very large additions to this group, which are particularly valuable because many of the forms are represented by both sexes, and in not a few instances by the larvae and the gall from which the insects were reared. Other additions to the State collections have been large, there being a total of over 10,000 pinned specimens. A number of very desirable species have been obtained through exchange.

The additions to the State collection during the past three or four years have ranged from 10,000 to 15,000 pinned specimens, all of which have to be properly labeled, assigned to their various groups and eventually determined. There has been, since the present entomologist took charge of this office, an approximately six-fold increase in the size of the State collection. A large proportion of the curatorial work in connection with arranging the collections devolves upon the assistants, and it is a pleasure to state that material progress has been made along this line. Assistant Entomologist D. B. Young has, during the past year, given considerable time to classifying the parasitic wasps, Ichneumonidae, and a portion of the Braconidae and also Hymenoptera belonging to the following groups: Pompilidae, Larridae, Bembecidae, Nyssonidae, Philanthidae, Pemphredonidae and Crabronidae. He has also done more or less incidental work with the Diptera. Assistant I. L. Nixon determined and arranged a number of the solitary bees, Andrenidae, assisted in arranging the Ichneumonidae and determined and arranged many of the Curculionidae. In addition he went over the Hill collection, noticed below, repairing and arranging many of the specimens and is responsible for a portion of the catalogue of this collection.

The Hill collection, an exceptionally valuable addition to the State collections, was received through the generosity of Erastus D. Hill, Carrie J. Hill Van Vleck and William W. Hill, heirs of the late William W. Hill, who desired that their father's work should be maintained as a permanent memorial of his labors in entomology. This collection consists of some 10,000 specimens, representing approximately 3,500 species and is in excellent condition. It contains a large number of native species as well as representatives from Europe, Asia and Africa. The catalogue of the species is included as an appendix to the Entomologist's report.

V

REPORT ON THE ZOOLOGY SECTION

Research and field work have claimed the major attention of the Zoologist and the Taxidermist during this year. It has not been deemed worth while to consume much time upon the exhibition collections, in view of the complete rearrangement which will be necessary with the occupation of the new building. As usual the birds have received the chief attention. The New York series has been restored to order and many new mounts replace old ones. A portion of the older material replaced is available for loan to schools. The avifauna of the State is now represented by all but 17 of the species recognized as occurring within our borders, an increase of 17 since the last report. Among the species thus added are some specially noteworthy, such as the record specimens of European linnet and yellow-billed tropic-bird for which we are indebted to the generosity of their owners, and New York specimens of Gyrfalcon and passenger pigeon. A specimen of scaled petrel is also among the accessions. Several of the forms still missing are not rare, but no specimens of satisfactory quality have been proffered. In order that the friends of the museum may be aware of its needs, the list of these lacking species is subjoined:

Skua, *Megalestris skua* (Brunn.)
 Trudeau's tern, *Sterna trudeaui* Aud.
 Black-capped petrel, *Aestrelata hasitata* (Kuhl)
 Booby, *Sula sula* (Linn.)
 Black brant, *Branta nigricans* (Lawr.)
 Barnacle goose, *Branta leucopsis* (Bechst.)
 Eskimo curlew, *Numenius borealis* (Forst.)
 Burrowing owl, *Speotyto cunicularia hypogaea* (Bonap.)
 Skylark, *Alauda arvensis* Linn.
 Holboell's redpoll, *Acanthis linaria holboelli* (Brehm)
 Baird's sparrow, *Ammodramus bairdii* (Aud.)
 Lark sparrow, *Chondestes grammacus* (Say)
 Lawrence's warbler, *Helminthophila lawrenci* (Herrick)
 Brewster's warbler, *Helminthophila leucobronchialis* (Brewst.)
 Palm warbler, *Dendroica palmarum* (Gmel.)
 Townsend's solitaire, *Myadestes townsendi* (Aud.)
 Bicknell's thrush, *Turdus aliciae bicknelli* (Ridgw.)

From the hypothetic list the following six species, three less than last year:

Lesser fulmar, *Fulmarus glacialis minor* (Kjar.)
 European teal, *Nettion crecca* (Linn.)
 Masked duck, *Nomonyx dominicus* (Linn.)
 Cory's least bittern, *Ardetta neoxena* Cory
 Cooper's sandpiper, *Tringa cooperi* Baird
 European green-finch

A group of Sora rail has been completed and awaits casing.

A family of black bears, consisting of a female with two cubs, and a male, is being mounted by the Ward Natural Science Establishment, after sketches submitted by Mr Charles Livingston Bull. The female is shown in an attitude of protection for the young against the possibly unfriendly intentions of the male. Mr Bull entitles his drawing "The Intruder."

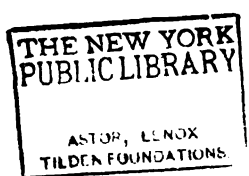
The Taxidermist is engaged upon a mount of the muskrat and its haycock nest, showing the construction of the interior.

The Zoologist has continued his studies of the Arachnida, and has completed a synoptic check list and key to all the known acarians, phalangids, pseudoscorpions, pycnogonids and xiphosurans occurring within the borders of our State. This work will be offered for publication as soon as the illustrative diagrams have been prepared, and will be followed shortly by the list of New York spiders compiled last year, which requires some additional keys, thus giving a complete index to the present knowledge of our arachnid fauna. In the prosecution of this labor he has been impressed by the need for systematic work upon our species of mites, and especially the gall mites, or Eriophyidae. As an appendix to the check list he is preparing a list of all the forms of mite galls and their host plants recorded from this country, together with a number of new forms occurring in the collections; of this list of nearly 150 forms of galls, only about one fifth have had their mites described and named. A collection of pressed specimens of these mite galls has been commenced and contains many interesting Cecidia. A large collection of the spiders, mites and other arachnids of the State is now available for study.

The reserve collection of Unionidae, or fresh-water mussels, has been partially rearranged and made available for use in illustrating the forthcoming report on those forms. This rearrangement should be completed as rapidly as possible. It is already evident that the State collection of these forms is unusually large and symmetrical, a fact which its scattered condition did not reveal.

The Zoologist terminated his official connection with the museum on September 15th, but his interest and good will still bind him to it, and he hopes to complete the check lists above mentioned at an early date.

Birds of New York. The first volume of this work covering the general and introductory discussion and specifically the accounts of the water birds with 39 plates in color, is practically ready to



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communicate for printing. The scope of the work is such as to make it necessary to devote two volumes to the memoir. The preparation of the second volume is well forwarded and it is expected that the entire work will be in press during the coming year.

VI

REPORT ON THE ARCHEOLOGY SECTION

The wampums of the Iroquois Confederacy. By virtue of the action of the Onondaga Nation in 1898 in electing the University of the State of New York the wampum keeper of the "Five Nations and Six Nations, and each of them" and by the purchase of these wampums at that time through the Onondaga Nation as keeper of all the wampums of the Iroquois Confederacy from the funds of the State Museum, these invaluable archives of the Confederacy have come into the custodianship of the Director of the State Museum, to whom, by the action of the President of the Onondaga Nation, has been transmitted the historic title Ho-san-na-ga-da — Keeper of the Name. Although complete records of these wampums have been kept in the manuscript files of the museum it seems well to make the record more permanent and decisive by introducing in this place photographic copies of each piece of wampum received at that time from the chiefs of the Onondaga Nation. These illustrations are herewith given.

Work of the section. As an organized department of the State Museum, the Archeological section began on October 19, 1906. The work which devolves upon this section has necessitated its subdivision into several subsections as follows: archeology, ethnology, anthropometry and osteology, and philology and folklore.

Each of these branches is necessary for the preservation and study of the prehistoric and recent relics and remains of the New York aborigines. The work necessary to carry on each of these branches is nothing less than enormous as will be realized when it is stated that it is required that one person, the Archeologist, carry on field work in archeology for at least four or five months of the year, collect ethnologic specimens from the Indians, study, classify and catalogue all the archeologic and ethnologic material acquired, study, measure, record and catalogue all the features of the human remains exhumed from the ancient graves and ossuaries, to collect and record legends and ceremonial rituals and songs from the Indians, and to transmit proper reports covering these activities.

1 Council summons, calling the clans to a meeting. This belt is said to be a memorial to the clan laws of Hiawatha. By some it is considered an alliance belt sealing a pact between the Seven Nations of Canada and the Iroquois.

2 Treaty belt. Originally there were five diagonal bars.

3 Remembrance belt. Records the treachery of a French missionary at Onondaga who sought to summon the French army from Canada. It is an admonition against the French religion.

4 Caughmauwaugua belt. Records an alliance between the Caughmauwauga tribe and the St Regis band. The crooked lines indicate that the former had forsaken the old ways for the white man's religion.

5 Condolence belt of the Senecas once held by Governor Blacksnake. It was used in mourning councils in the ceremony of raising the new names and new sachem to office.

6 Huron alliance belt, said to symbolize the alliance of the Hurons with some other tribe. After the overthrow of the Hurons in 1650 it became a Seneca belt and was taken to Canada after the Revolutionary War.

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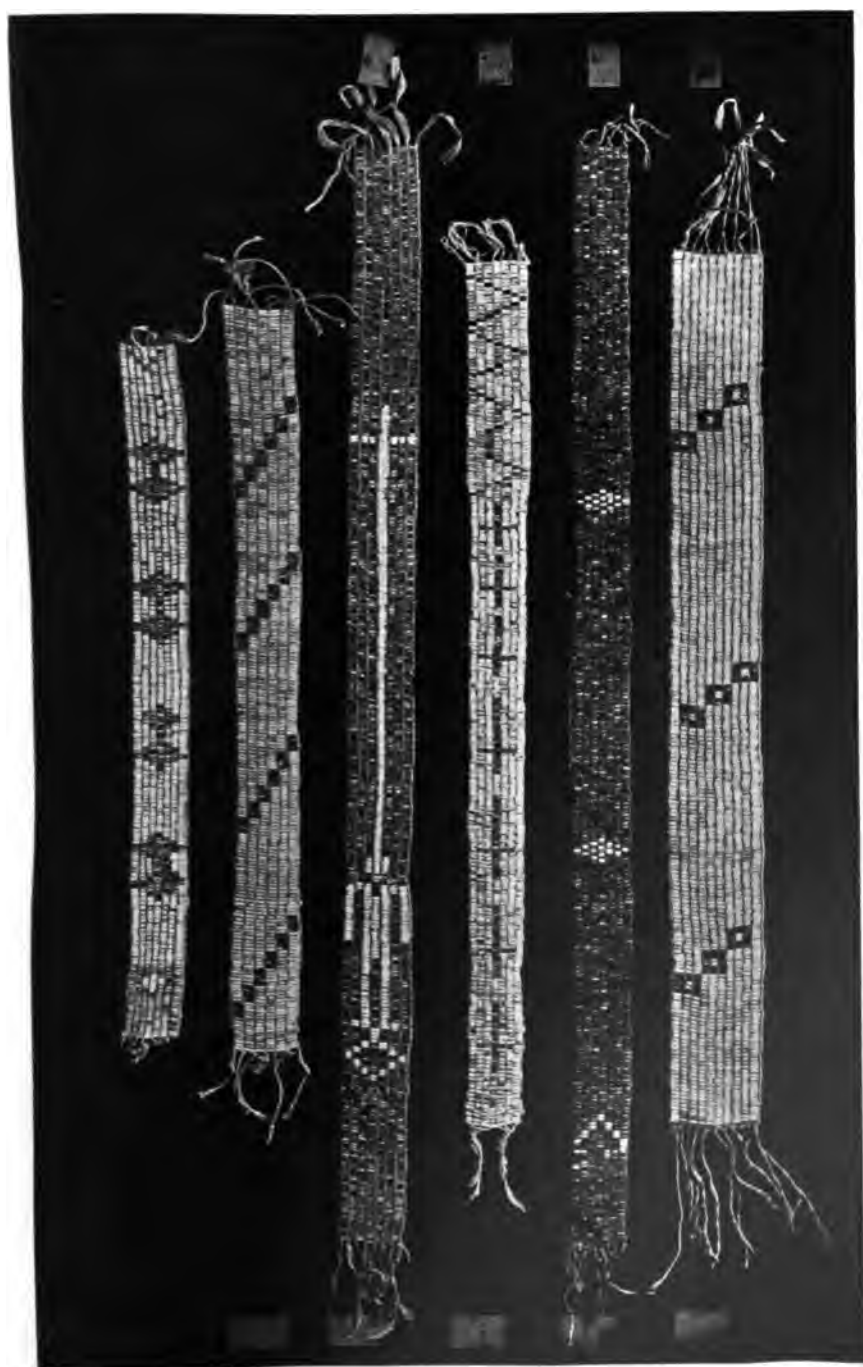
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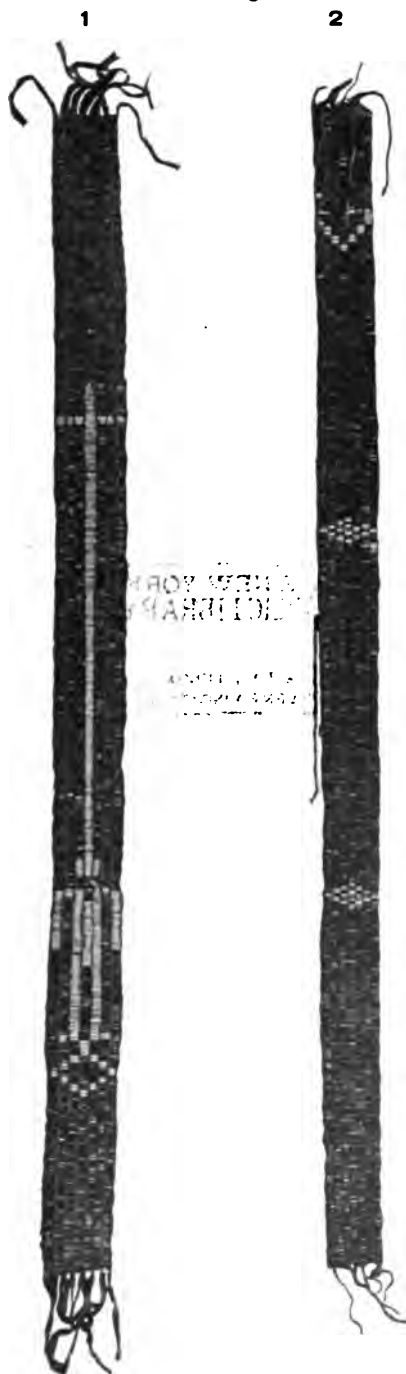
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Plate 23

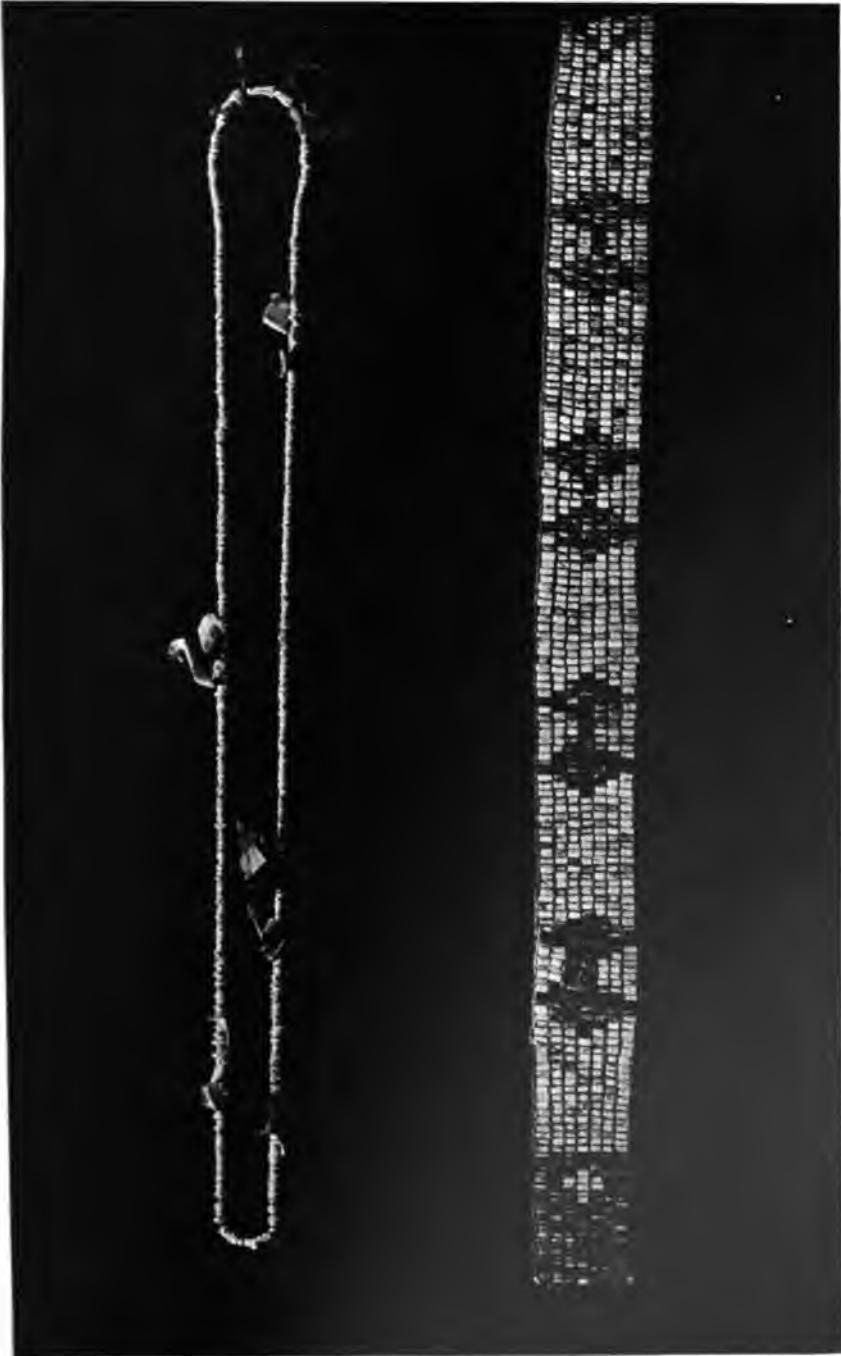


- 1 Same as figure 3, plate 22
2 Same as figure 5, plate 22

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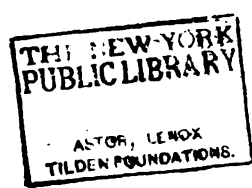
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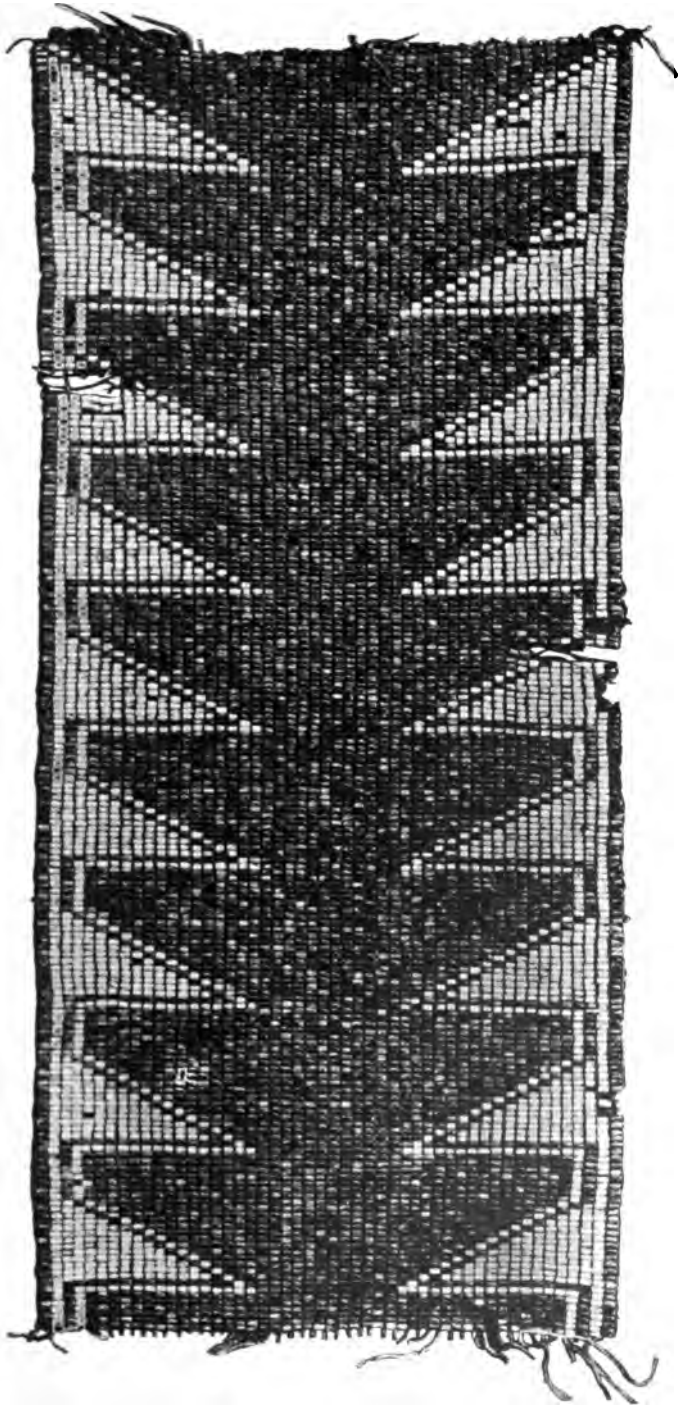
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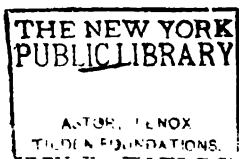
1 String of disk wampum used by the Canadian Delawares in naming ceremonies.

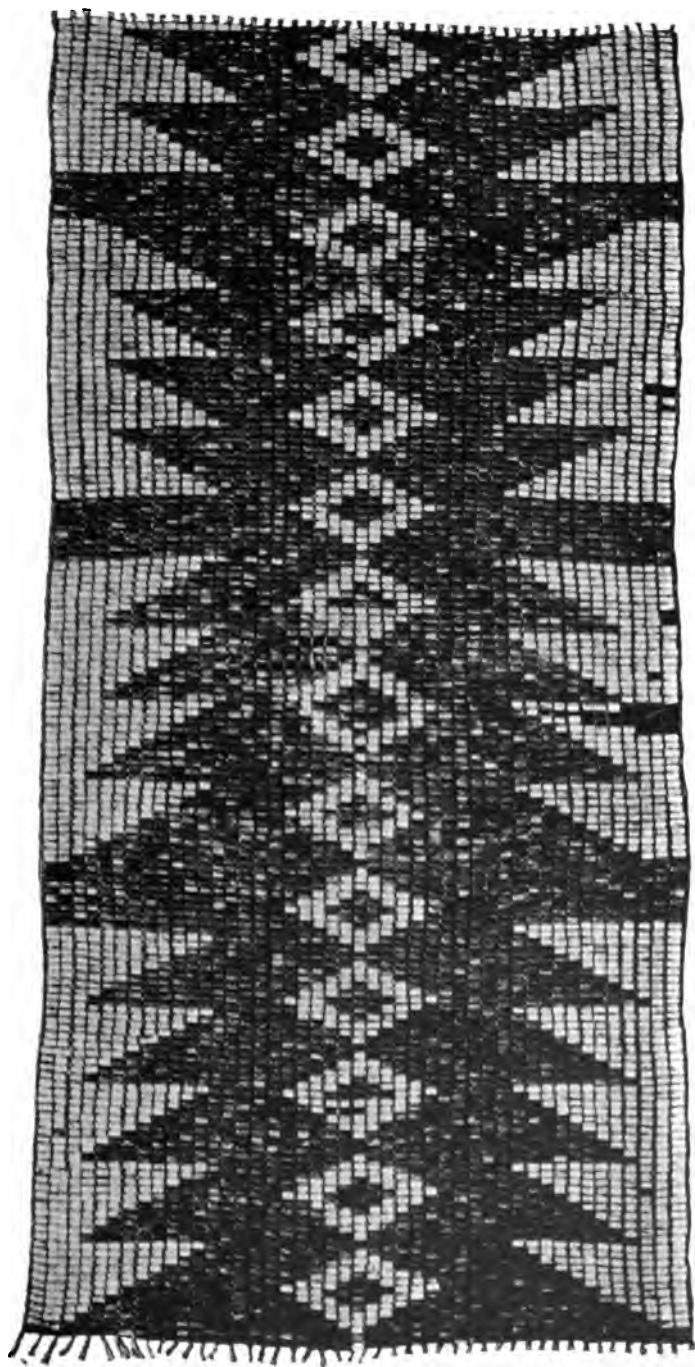
2 Same as figure 1, plate 22



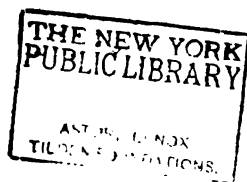


Wing, or Dust Fan of the President of the Council. This is an Onondaga national belt and the largest known, being $31\frac{1}{2}$ inches long and 50 beads wide. The design is said to represent an endlessly growing tree which symbolizes the perpetuity of the league.



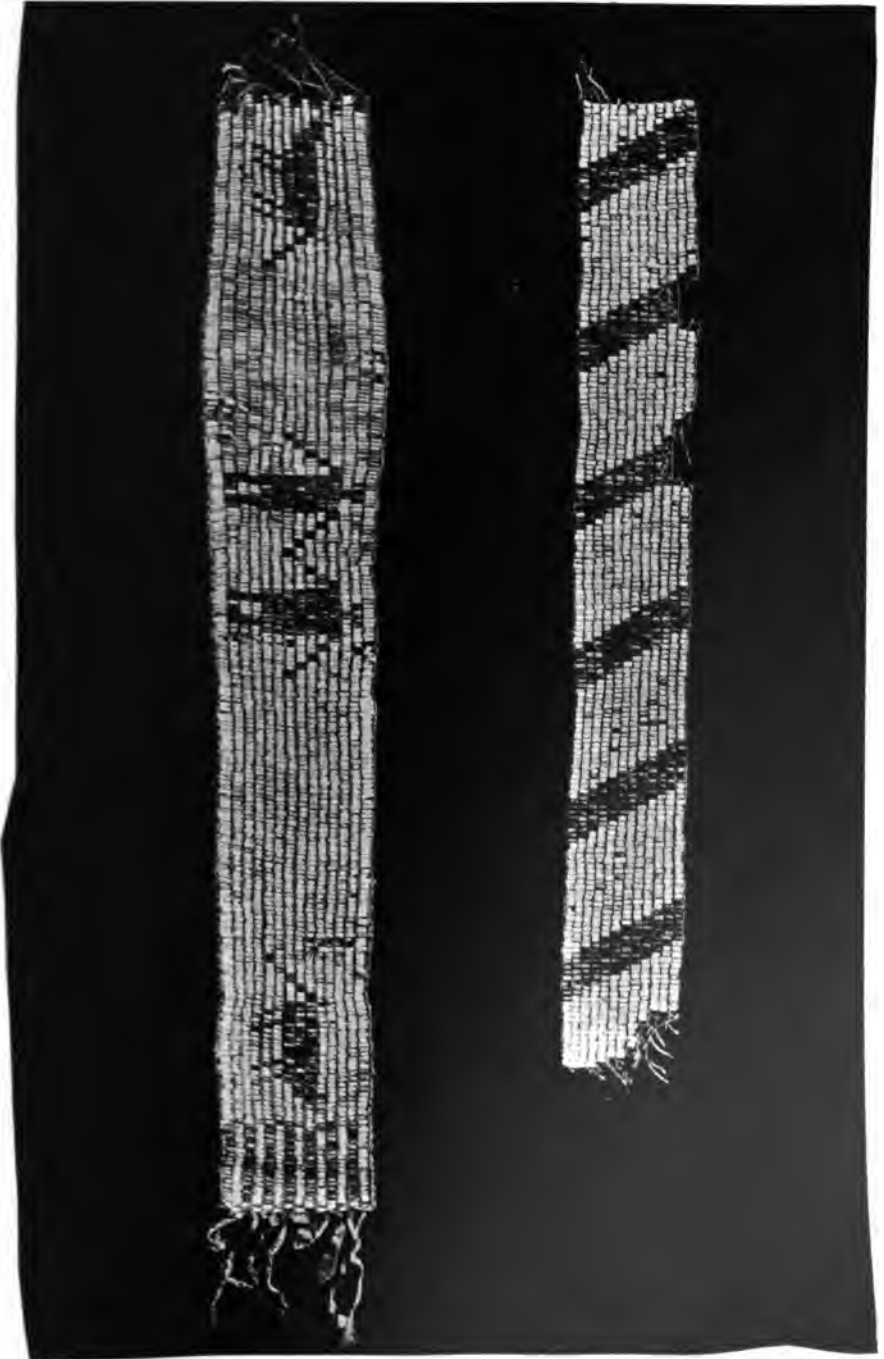


To-ta-da-ho belt. Sometimes called the Presidentia. It is the second largest belt known, being 27 inches long and 45 beads wide. The series of diamonds in the center is said to represent a covenant chain always to be kept bright.

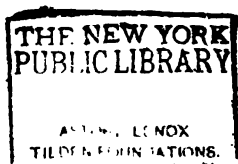


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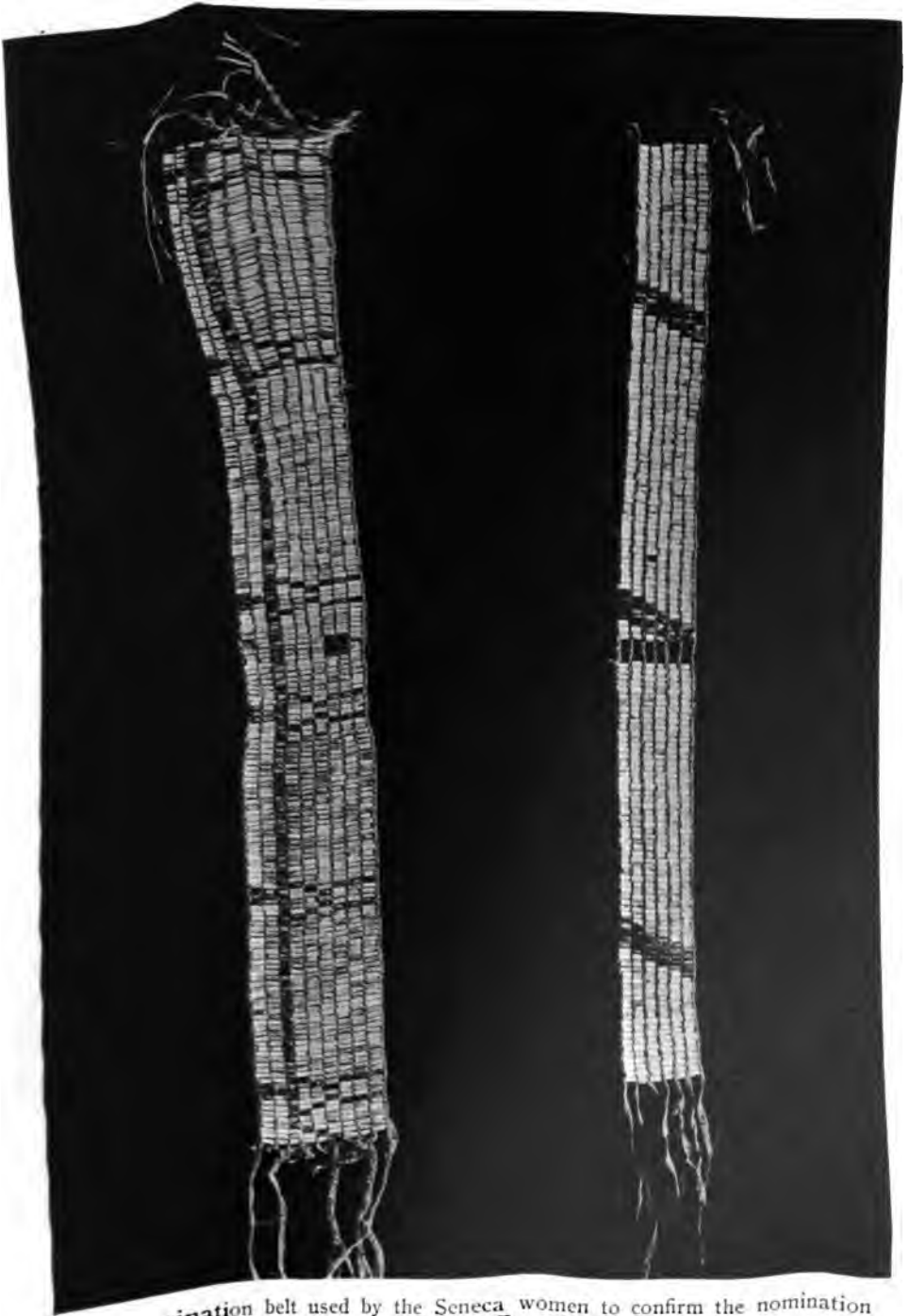


1 Wolf treaty belt. Said to represent the alliance of the Mohawks with the French. The wolves at either end symbolize the "Door Keepers" of the league. This was a Mohawk national belt.
2 Alliance belt, said to commemorate the entrance of the Tuscaroras in 1713. Onondaga national belt



1

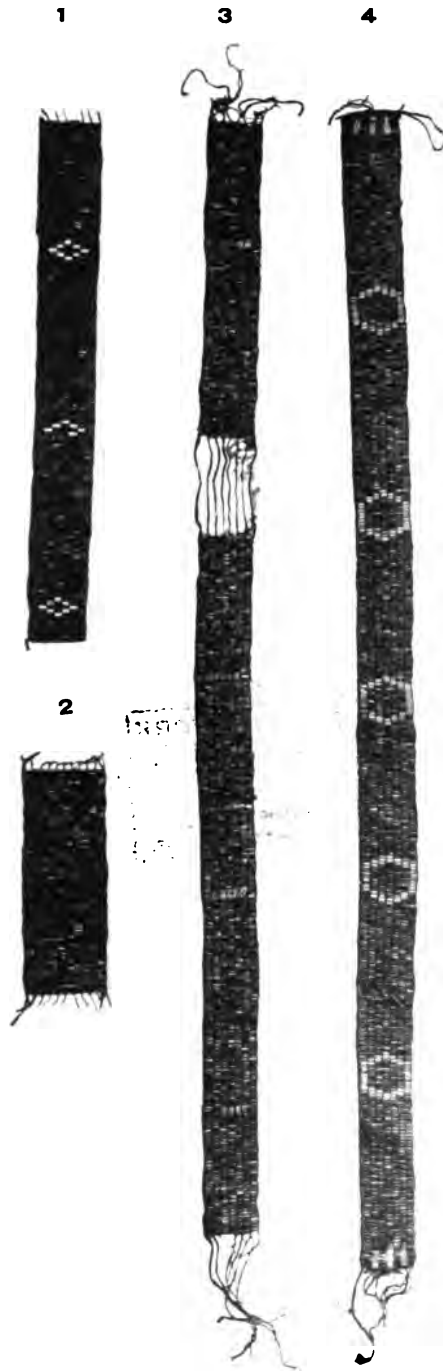
2



1 Nomination belt used by the Seneca women to confirm the nomination of the sachems which they chose for office. This was the Seneca women's national belt.
2 Hospitality or Welcome belt. Said to have been used in league councils by the presiding chief in welcoming the delegates.

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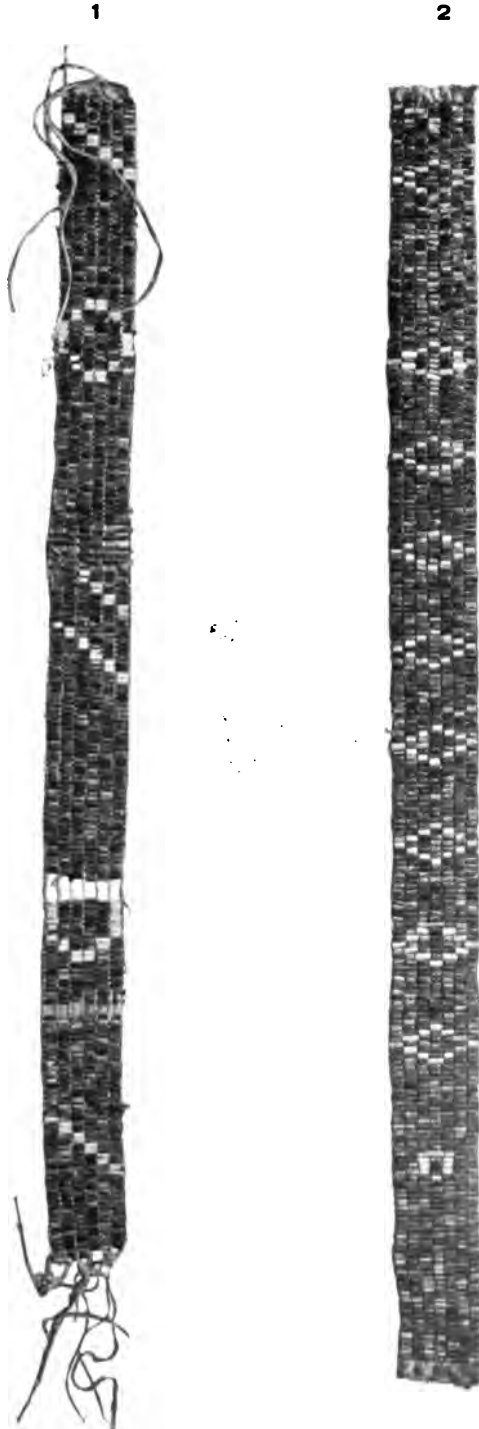
1 The Five Nations alliance belt. A perpetual reminder of the national union. This belt is mutilated.

2 Gyantwaka treaty belt. A fragment of the belt passed to the Indians at the sealing of the Cornplanter reservation treaty. Other portions of the belt were cut up and divided among the heirs of Cornplanter.

3 Cornplanter's personal belt. This belt and a beautifully engraved tomahawk, both in the State Museum, are probably the only relics of the distinguished chief who destroyed all his effects for religious reasons.

4 Belt of the Keeper of the Western Door. Sometimes called the Parker belt, from Gen. Ely S. Parker who held it as the Do-ni-ha-ga-wa of the confederacy of the Five Nations.

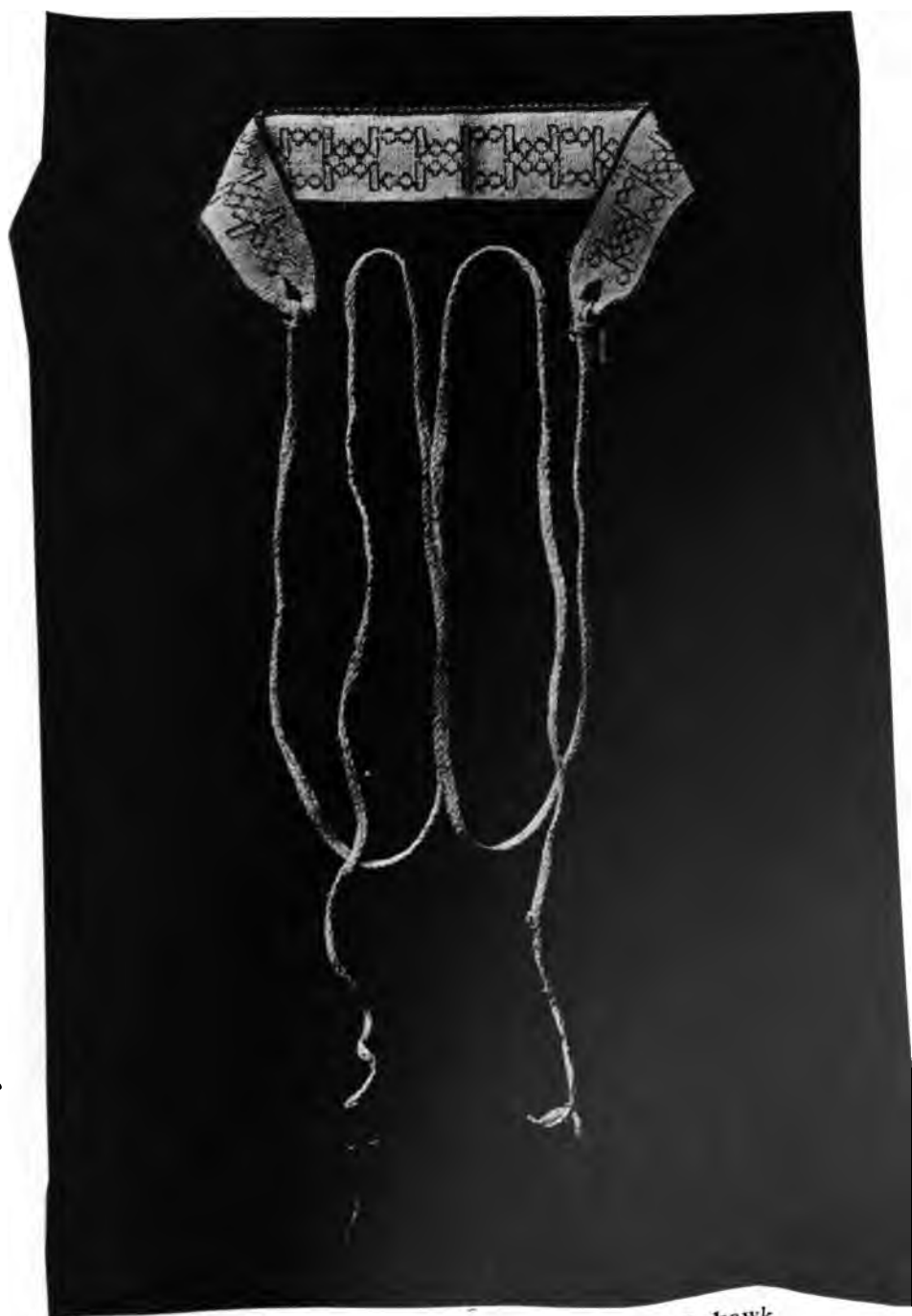
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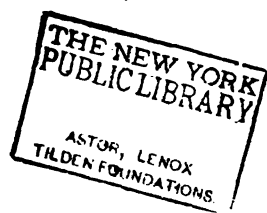
1 Ransom belt. If presented by the youngest unmarried female, the relative of a murderer, to the avenger of the slain it would ransom the life of the guilty party.

2 The Lewis H. Morgan belt. Made at Tonawanda in 1850. Said to symbolize the peace between clans and villages. This never was a national belt.

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Pack strap woven from basswood bark fiber. **Mohawk**





Cayuga necklace of worked deer phalanges and knee rattles of deer hoofs

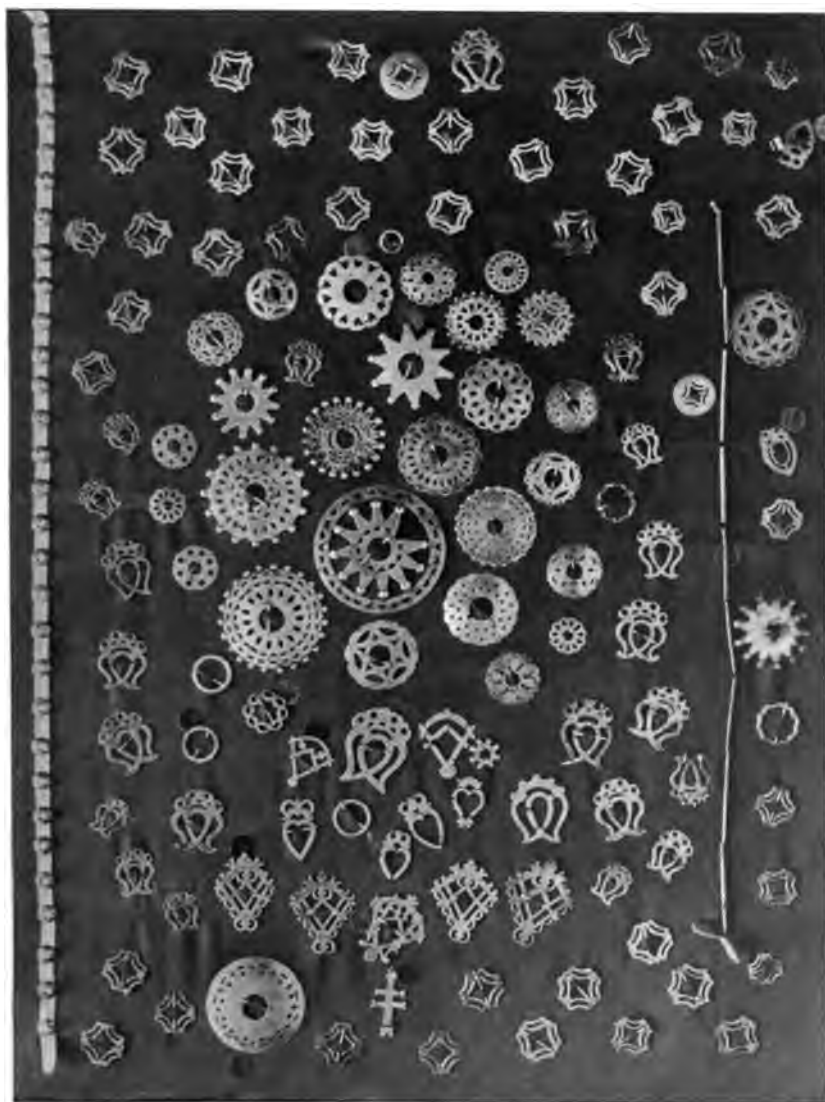
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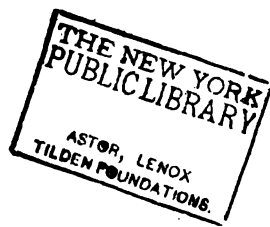
Red Jacket's side pouch and knife sheath. Buckskin, embroidered with porcupine quills

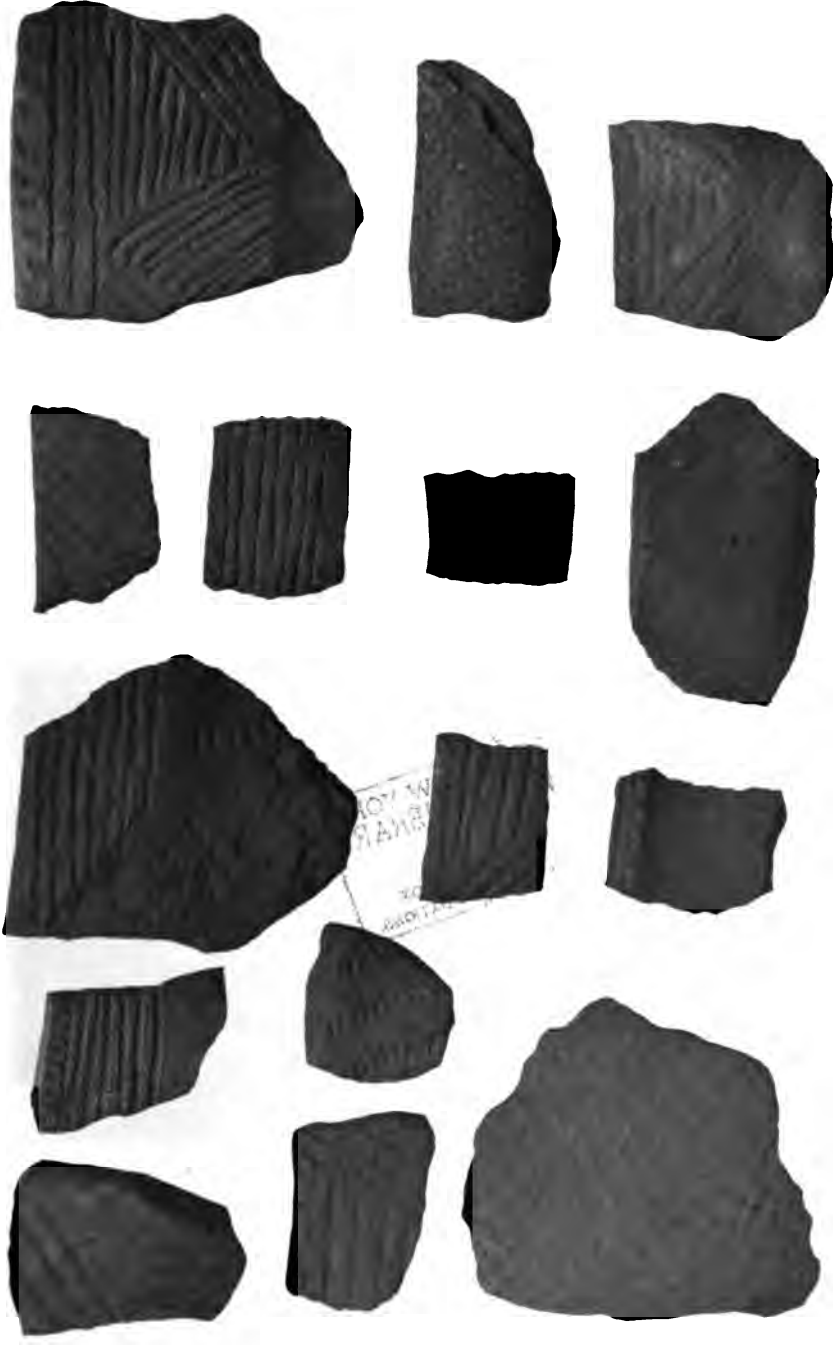
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Plate 34



Part of the Harriet Maxwell Converse collection of silver brooches





Potsherds showing range of ornamentation of pottery; Luke I. Fitch collection

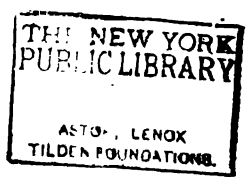
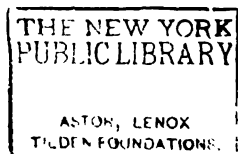
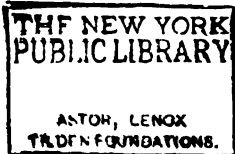


Plate 36



Maternity pipe from mound; two views. Probably post-Columbian



and *Symbolism of the New York Indians*, it is hoped, will fill a want felt by artists, designers and craftsmen in general. It will set forth the forms of artistic creations, decorations by incision, quill embroidery, bead work, carving, stamping, painting and metal work devised by the New York Indians.

Public interest. That public interest in the archeology of this State is steadily increasing is attested by the large numbers of inquiries received by mail and by the number of visitors who personally state the inquiries. Full replies in all cases have been given.

Collections acquired. Several valuable collections of archeologic and ethnologic material have been acquired for the museum during the past year.

Among these are collections from W. H. Hill and M. R. Harrington, of New York city; and L. I. Fitch of Manlius, N. Y.

The Hill collection embraces a number of valuable pieces of silver work such as disks and crowns, bead work and two pieces of wampum, one a belt and one a wristlet.

The Harrington collection is one of the most valuable acquired for many years and consists of ethnologic material purchased from the Iroquois on the Grand River reservation in Canada. Many of the specimens were lacking in our collections and could not be obtained among the New York Iroquois.

The Fitch collection consists of Onondaga archeologic material obtained from Pompey Hill, N. Y., and includes specimens that range from the prehistoric forms down to articles of modern time.

The Archeologist visited the Indian reservations during the summer and acquired a number of valuable objects which up to this time had not been represented among the ethnologic series. Among these objects may be mentioned prayer rattles, ceremonial headdresses, an Indian silversmith's outfit of tools, blow guns, ceremonial robes and mats.

FIELD WORK IN ARCHEOLOGY, 1907

Following out the plan to thoroughly examine each culture district in New York State, the field researches in archeology during the season of 1907 were made in the territory reputed to be that of the Eries. The coast or lake shore culture having been examined last year with splendid result, it seemed advisable to examine the region upon and about the Chautauqua hills. Numbers of sites had been noted here and for at least 60 years it had been a territory interesting to archeologists, although no excavation had ever been

made systematically. Excavations made 30 years ago in some sites had yielded large quantities of human remains and the ploughing of other places had produced annual crops of relics in others. Nothing definite was known of the character of these places, nor of the stage of art and culture represented by them. Commonly they are described as being the remains and artifacts of the Eries whom history places in this region.

A survey of Chautauqua county led to the discovery that there were at least three distinct cultures or successive occupations of this region differentiated by very wide characters. There seems some evidence also of a fourth occupation. The oldest occupation definitely traceable is that characterized by the notched and shouldered arrow point and spear point, by the total absence of pottery and bone implements, by the absence of pits except a few shallow ones containing charcoal only. The village sites of this culture and occupation are situated alike on hills and in valleys and seem to have been spread out rather than close together. On sites of this description the gorget, bird and banner stone and other polished slate articles have been found, although most of the celts are of the common type, that is, symmetrical and equilateral. Stone pipes are sometimes found, some of which are of the mound-builder type. Mounds in which these same articles have been discovered seem to indicate that the mounds are relics of this occupation. These mounds are nowhere as large as those of Ohio and Wisconsin, and seldom exceed 50 feet in diameter and 8 or 10 feet in height. On sites of this description grooved axes are sometimes found although they seem to have been acquired from another culture elsewhere by trade or otherwise. The human remains of the occupation are extremely rare and probably none have ever been found suitable for measurement or comparison.

The second distinct culture is that known as the Huron-Iroquois and is susceptible of two divisions, the prehistoric and historic. The historic or second stage of this culture is undoubtedly Erie, but the prehistoric or first stage is better termed Huron-Iroquois and differs from the second in several material points.

The third culture or occupation traceable is that of the Confederated Iroquois, presumably the Senecas who held tracts of land here during the late part of the 18th and early part of the 19th centuries. This occupation was not of long duration nor are its evidences widely traceable.

The early Huron-Iroquois occupation is characterized by inclosures surrounded by low walls of earth, by ossuary burials, by

triangular arrow points, by a lack of notched spears, by a lack of objects buried in the graves, by their pottery, by shallow pits containing no bone objects nor bone refuse, but frequently some pottery and flint chippings. The earth inclosures vary in area from less than an acre to 5 or even 7 acres. When convenient, points of land extending from a terrace out into the valleys were fortified at the neck and cut off from the general plane. The earth circles or inclosures and fortified necks are locally termed "Indian forts" and some undoubtedly were such. Some old writers have called them "ceremonial rings" and have expatiated on the wonders of the "true circles." Investigation, on the contrary, demonstrated that only a few approach true circles and adduces no evidence to prove them of a ceremonial character. Often they have been erroneously regarded as works of the Mound Builders.

The later Huron-Iroquoian occupation becomes more specific and is recognizable as the Erian. It differs from the older occupation in that the burials contain flint and shell objects, pottery of different form and decoration. Refuse, that is broken bone implements, pots-herds, rejected flints and entire objects, evidently swept in accidentally, is found in abundance in pits and sunken fireplaces.

The later Erian occupation, the historic, that is to say those sites which yield objects of European manufacture, differ noticeably from the earlier sites in several respects. The pottery seems to have undergone a gradual change until the Eries were destroyed, the most varied forms and decorations being of the historic period.

Early in the month of May a preliminary examination was made of some of the earthworks in that part of Chautauqua county lying south of the Chautauqua range of hills in the Allegheny-Ohio watershed. The outlook seemed a promising one, judging from the abundance of earthworks visited and reported. The Cassadaga valley was of especial interest and a season's campaign of investigation was planned for this region. Upon the uneven stream-cut hills that rise from the ancient lake bottoms were found everywhere traces of an early people which seemed eminently worthy of study. How numerous are the fort sites may be suggested when it is stated that from a hill just over the town line in Charlotte are to be seen the sites of seven and possibly eight fort and camp sites.

McCullough earth inclosure. One of the sites to which considerable attention was devoted is situated in a sugarbush on the Martin McCullough farm, lot 38, Gerry township. Here sur-

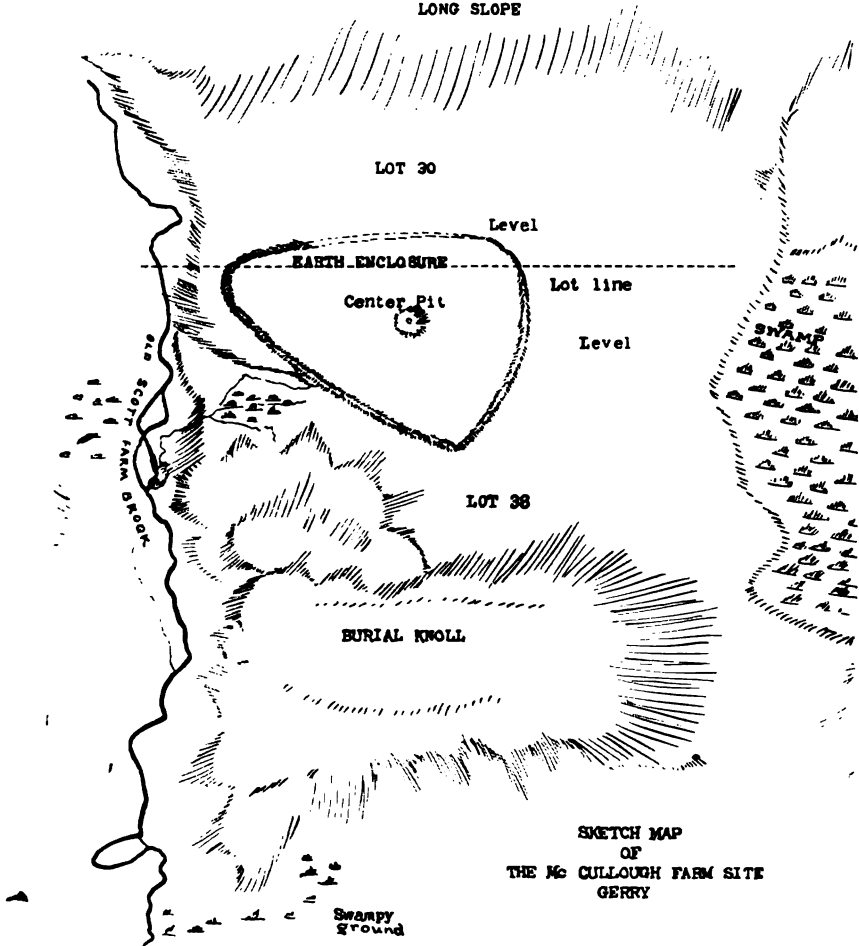
rounded by a swamp from which rise sloping hills is a rise of land some 3 feet above the swamp level. Upon this rise of ground is an oval or rather kite-shaped earthwork 1297 feet in circumference. The wall is now from 22 inches to 24 in high and is composed of the earth which was scooped from an outer ditch bordering the wall. This earthen ridge first attracted the attention of Obed Edson who some 50 years ago was engaged in running the lot lines. Some mention of it is contained in the various county histories to which he has contributed or written. Numbers of men distinguished in archeologic science have visited the place and more than a dozen years ago representatives of the Smithsonian Institution made some investigations there. To the west of the earth wall rises a small knoll which appeared to be composed of glacial sand and to the north running through a little valley is a brooklet. Within the wall are numerous pits or depressions 5 or 6 feet in diameter and 3 to 9 inches deep. These, upon examination, proved to be shallow refuse pits with an original depth of from 1 to $2\frac{1}{2}$ feet. A rather remarkable pit is situated almost in the center of the inclosure and measures 157 feet in circumference with a depth of 5 feet. The earth wall is surrounded on its outer side by a ditch which is at present but little more than a foot below the normal level of the surface. The wall at present is on the average 8 or 9 feet through at the base and the crest of the ridge rises 2 feet in places. The ditch and wall are entirely visible in lot 38 and the wall may be traced in lot 30 where the ground has been cultivated for several years. An enormous white pine stump stands on the northwestern side of the wall. A cross-section of this stump was made by Hon. Obed Edson and more than 400 rings were counted. At the northwest corner of the earthwork where the stump stands, the surface of the ground is 20 feet higher than the brook bed which lies to the north 25 feet distant. At the lot line on the east the earth wall takes an abrupt turn almost at right angles and runs about parallel to the line for 450 feet.

Within the inclosure at about its mid point is the bowl-shaped depression, previously mentioned. This pit is 5 feet deep and 50 feet in diameter. In area the inclosure is about 3 acres.

It was found after some expenditure of time that very little in the line of movable material data bearing on the original inhabitants could be hoped for. Specimens of the arts and manufactures were few and fragmentary. However, bearing in mind that the problem was to discover the identity and characters of the builders of the

Plate 37

LONG SLOPE



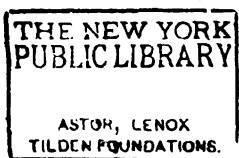


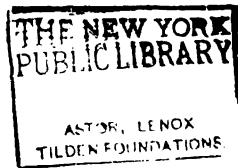
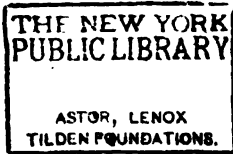
Plate 38



The central pit in the McCullough earth inclosure



View looking over the burial knoll. Ossuary 5 was found near the stump shown in the left-hand corner of the picture.



earthworks, it was deemed advisable to continue until it could be thoroughly studied and every important fact obtainable brought to light. Since the area within the inclosure refused to divulge all the desired information, it was sought to discover the burials and wring from the crumbling bones of these swamp dwellers some word or fact to dispel the mystery.

Burials

Post holes were dug in the ridge to the west of the earth-walled inclosure to discover, if possible, whether or not there were any burials, it being the spot most suited for graves, in point of accessibility. The surrounding ground was swampy and the loam but a few inches in depth when a stiff clay or hard pan was encountered. The knoll on the other hand was dry and sandy.

After 40 tests had been made, running from the brook on the north in a southerly direction, an area of disturbed earth was found and a trench staked out for systematic excavation. Following the rule the trench was 1 rod wide. Trench 1 was run over the crest of the ridge from south to north.

Burial 1, was found at 16' in the middle of the trench 20" below the surface. A root-eaten skeleton of a young female was discovered. The skull was crushed at the top. Only the skull and upper ribs and upper arm bones were found. The other bones were not to be found. The head lay to the northeast, face northwest. 28" southeast and above the head was an ash pit 18" deep. It was filled with white ashes. The superincumbent soil was sandy and intermixed with bits of charcoal.

Burial 2. At 16' on the west side of the trench, 36" below the surface and opposite burial 1, burial 2 was discovered. The skeleton was that of an adult male and lay in a flexed position. Measurements of the skeleton as it lay led to the following data: 33" from top of skull to heel; knee to back, 9"; pelvis to top of head, 33". The soil was strewn with charcoal bits and potsherds. A black fibrous phosphate was noticeable in the grave soil.

Two empty graves were found between this burial and the next (No. 3). Their character as graves was shown by the soft, loose and disturbed soil which lay surrounded by the hard, undisturbed grit. It was an easy matter to shovel out the grave soil because of its looseness, without disturbing the wall of the grave. Only a few fragments of bones were discovered in these empty graves.

Burial 3. Discovered at 34' on the west side of trench 1, 26"

down. Skeleton was that of an infant 8 or 9 years old. The skull was crushed. The body lay in a grave outlined by a row of flat stones placed upright on edge. Orientation: head, east-southeast; face north-northwest; right side, flexed. Body lay east-southeast by north-northwest. From top of head to end of toes 2' 3". Black phosphate in grave. Ash pit south of skull at 18". Grave soil much disturbed.

Burial 4, was found at 33' on the east side of the trench. The depth was 25" and the grave outline 60" by 35". A decayed male skeleton lying in the usual flexed position. Orientation: head, south-southeast; face west-southwest, left side. The skeleton as it lay measured 36" from top of head to heel and 15" from knee to back. The superincumbent grave soil was much disturbed. An ash pit 2½' in diameter and 1' deep was found just south of the grave.

Between graves 3 and 4 there was a streak of disturbed earth 30" deep, as if the entire ground had once been turned over to this depth. There was a thin separating wall as if there had been two other graves here.

Burial 5. At 40' on the east side of trench 1 the tops of two boulders were struck and a few inches north of them a heavy bed of white ashes. Beneath the ash bed, 11" from the surface of the ground the tops of several skulls were touched. Careful excavation revealed a small ossuary containing the remains of parts of 14 skeletons.

The bones were placed in a rectangular heap measuring north-east to southwest, 2' 4", by northwest to southeast, 1' 8". The large bones, femora, tibiae, etc., lay northwest and southeast. Six skulls were arranged around the top of the ossuary and beneath them were four others, all broken. When the bones were removed 27 femora were found which would indicate parts of 14 individuals. The earth had packed about the outer bones and had not fallen into the interstices of the bone heap below. The area of the disturbed earth was, in diameter, 4' 6". The two boulders south of the ossuary had probably been placed as hidden markers. Large stones had not been encountered before in the sand of the knoll.

Just beyond the ossuary to the south was a large ash pit 48" in diameter.

In depth the ossuary was 16", or from the top of the ground to the bottom, 27".

Burial 6. This grave was discovered at 37' outside of trench 1, on the west side. It was 36" deep, 36" wide and 55" long.

Plate 39



Grave 2, McCullough site



Grave 3, McCullough site

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Grave 6, McCullough farm site, Gerry, N. Y.



Ossuary 5, McCullough site

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This grave unlike the others seems to have been an original burial, that is to say, the earth had not been overturned more than once. The other graves seem to have been used several times, the bones being removed for ossuary burial or other disposition, and a new body interred therein.

The skeleton was that of an adult male of mature years, (about 60). A heron's lower mandible was found at the forehead as if it had been used as a hairpin.

The earth had packed about the limbs and neck and left in the clay-mixed sand a cast of the body. A black phosphate surrounded the bones, the remains of the animal tissue.

Measurements of position gave the following data: knee to back, 17"; atlas to *os innominata* 2' 5"; atlas to end of tarsus, 3' 2".

Orientation: head east; face, south; left side, flexed.

Bones in good condition except those of the two lower arms.

Burial 7. Another grave was opened at 44' on the west side. It was 30" deep and contained only a few decayed vertebrae and a deposit of grave dirt. The larger bones had probably been removed for ossuary burial.

Burial 8. At 49' on the west side, grave 8 was found. It was 19" deep and contained a few decayed bones, part of a femur and the crushed remains of a child's skull. Over this grave was a layer of shale slabs. At the south end of the grave was a boulder 12" in diameter. It was 18" below the surface.

The skull lay with the top east. A large piece of shale lay directly beneath the pelvis. Between this grave and the next was an ash bed 7" deep.

Burial 9. At 50' in trench 1 touching the line on the east side, 20" below the surface, the top of another ossuary was uncovered. Excavation disclosed a bone pile 48" from north to south and 33" from east to west.

Unlike burial 5, the first ossuary, this was a promiscuous heap of bones cast without order upon a group of 20 skulls arranged in an oval. Four inferior maxillae, 6 broken femora, 5 humeri, a number of ulnae, radii, vertebrae, an astragalus, tarsus, ribs and pelvis were found in the heap over the skulls.

Of the 20 skulls, 10 were male and 9 female. Parts of another skull were found, but the sex could not be determined.

Over the ossuary was a glacial boulder about 18" by 18" and a covering of shale and fossiliferous Chemung rock.

Four craniums from the ossuary were in good condition and four others in condition for measurements. All are interesting for the characters they exhibit.

Burial 10. At 50' on the west side of trench 1 was an empty grave 24" deep. Over it had been cast a quantity of broken stone.

From the north wall of the ossuary, running north for a foot was a top layer of burned stone. The earth here had not been disturbed.

Trench 1 was temporarily abandoned at 54' and a parallel and adjacent trench run on the west side.

Burial 11. At 5' in the middle of trench 2 burial 11 was discovered. The grave area was 4' by 4' and the depth 2 feet. The skeleton was that of a female. The skull was crushed. The arms were flexed to face, the left hand being under the left cheek.

Orientation: head, east; face, south; left side, flexed. Head thrown back.

Burial 12. Burial 12 was at 10' in the middle west side of trench 2. It was an empty grave with disturbed earth to the depth of 48"

Burial 13. Grave 13 was on the east side of trench 2 at 31'. It was 28" deep and contained the decayed root-eaten skeleton of an adult female.

Area of grave, 3' by 4'.

Orientation: head, east; face, north; flexed.

There was a small ash pit at the head of the grave.

Burial 14. Found at 43' in the middle of trench 2.

This grave was 28" deep and 3' by 3' in area and contained a male skeleton in a poor state of preservation. The tibiae were noticeably platycnemic.

Trench 3 ran parallel with 2 on the west.

Burial 15. Grave 15 at 4' on the west side of trench 3 was 19" deep, 19" wide and 30" long. There were no bones except the broken skull and the neck vertebrae.

Orientation: head, east-southeast; face, south-southwest.

Burial 16. Burial 16 at 44' on east side of trench 2 was 36" deep and contained the pelvic bones and sacrum of a young adult. No other bones were in the grave. This fact seems to point to a removal of the skull and larger bones for reburial.

Burial 17. At 36' in trench 3, 18' south of ossuary 1, pit 5, the third ossuary was discovered.

Six skulls were arranged in the form of an ellipse and the other bones thrown in the opening. These bones besides arm and leg

bones, included ribs, pelvis, phalanges, astragali tibiae, and vertebrae. There were two female skulls.

Burial 18. This burial was in the middle of trench 3 at 19' and 18' south of the ossuary (17). On the bottom of the grave a few potsherds were discovered but no visible trace of bone.

The problem of the many empty graves in the burial knoll was at first a puzzling one. Some graves contained a few ribs, some a pelvis, one or two arm bones and teeth and others were entirely empty except for traces of bone dust.

As a hypothesis the theory was then advanced that the parts of skeletons, the larger limb bones and skulls had been removed from the graves and deposited in the ossuaries; that the graves had been left, open or filled, for use again. The ossuary burial is a Huron, or perhaps more properly a Huron-Iroquois custom, and has usually, perhaps entirely, been held a mere matter of superstition or ceremonial custom. The presence of empty graves and overflowing ossuaries suggested the theory of the *economic utility of the ossuaries*. The virgin earth being difficult to dig, but once disturbed never packing as hard as before, it would have been a matter of labor, time and space saving to exhume the remains of the dead and reinter them in an ossuary, and to use the empty graves again as burial places.

These theories are only tentative and not to be regarded as established until numbers of other places shall have shown the same characteristics. It is also of importance that more than one observer should have noted them.

Excavations within the inclosure. The ground within the earth wall has not been disturbed since its aboriginal occupation except in places where sugar boilers had been erected.

Over 120 basinlike depressions were scattered over the surface and varied in diameter from 3' to 10', and in depth, from 6" to a foot. These pits were examined to discover their purport. Only six yielded anything in the way of relics. These consisted of flint chips, fire broken stones, pottery fragments and arrowheads. The earth was not disturbed in any case, except in that of the deep middle pit, for a depth of more than 30", the underlying soil being hard and impenetrable by crude implements.

Middle pit. This pit was carefully excavated. The soil was disturbed for about 9" below its modern surface except at the bottom where there was an ash pit 4' in depth and 4' in diameter. Mingled through the soil of the large pit was found a quantity of pottery,

flint and jasper chips, heat cracked stones and a number of triangular flint points. In the ash pit at the bottom, objects of the same character were found.

The presence of this large central excavation presents the problem of its purpose. To solve this question a number of hypothetical answers are adduced for consideration:

1st, it may have been a central refuse pit; 2d, it may have been a place of assembly, its gradual slope affording a seating place; 3d, it may have been an inner stockade; 4th, it may have been a reservoir into which water was conducted from the spring on the hillside to the east; 5th, it may have been excavated to obtain earth for filling in the northwest corner of the inclosure which is low and sloping toward a small gully which drains a spring marsh.

A careful examination of the ground showed that the northwest corner had been filled in, presumably with the soil excavated from the central pit. This examination also led to the several considerations. That the pit was not a reservoir is shown by the fact that ashes and refuse matter were found within it, though not in large quantities. That it was not a reservoir is also indicated by the fact that no ditch or outlet could be discovered. However, one may have existed and the pit been a reservoir previous to its use as a refuse dump, if such it was. The refuse matter in the pit did not occur in such quantities that it would be differentiated from "occupied soil" elsewhere, so that it may have been an inner stockade or place of assemblage.

Extent and character of occupation. There is evidence enough to point out that there was no long occupation of the site, the surface soil being but slightly disturbed to any depth. This evidence also suggests a settled occupation only in winter. The shallow pits seem to have been dug during the frozen season by alternately thawing and digging and in many instances also, to have been the sunken floors of lodges. If animal bones had been buried some would have remained as human bones did elsewhere in the site. This suggests that they were cast on the surface and afterward devoured by animals or lost by decay.

Purpose of the earth wall. The earth wall and trench are palpably parts of a fortification. From the crest of the wall, without doubt, rose a line of palisades which surrounded the inclosure. Indeed traces of these post holes were discovered all along on the ridge.

One of the strange facts which at once appears a curious anomaly is that if this inclosure had been a fortification why such a position

should have been selected, when, from the hillock to the west, arrows and stones or other missiles could have been easily thrown into the wall-protected inclosure. This very thing would have rendered the fort of little use in times of war or invasion. Two considerations then appear: first, that it was not a true fortification designed to protect the inhabitants from men only, but made for a protection from the wolves and other wild beasts which infested the region even in historic times; or second, that the enemies of the age held the acres of the dead as sacred spots and would not under any provocation desecrate the burial ground on the hill to use it as a vantage point from which to assail the living within the inclosure which the burial knoll overlooked.

Camp site outside of inclosure. To the southwest of the burial knoll rises another glacial kame which in length runs east and west. This kame contained 10 large ash pits, the one on the summit being 5' deep and filled with carbonaceous earth, burnt sandstone and charred corn. Between this kame and the inclosure, the earth had almost everywhere been disturbed and there was a heavy mixture of white ash and charcoal as if the vegetation and trees had been burned over many times. No implements were found here except a celt at the west end of the kame.

The soft mellow loam here also suggests its employment as a garden spot, possibly a cornfield. Charred corn was found in some of the pits.

Age of the remains. Several considerations determine the age of the remains. The absence of European articles at this place is a good indication that it is prehistoric. The difference between the characters of the occupation and those of the early historic Eries points out a pre-Erian or early Erian people. That they were early Iroquoian is evident from an examination of the artifacts but that they were early Erian is manifest by certain differences in form of culture and occupation. The remains would seem to be at least 500 years old and even a greater age may be ascribed.

No detailed description of the osteological remains of the aboriginal inhabitants of New York has even been attempted. It is the plan of the archeological section, therefore, to begin a systematic study of all the human remains which can be obtained within the limits of the State and finally issue a more or less complete report upon the subject. There is indeed a great need for such a guide, for the scientific value of such data has been almost entirely overlooked. A detailed study of the osteological remains found

at the locality described (Gerry) is being made in the laboratory, all the approved osteometric measurements and indexes being taken. Although this work is but partially completed at this writing, it is possible to give some of the figures and a few descriptions of the various morphological characters which the bones exhibit.

Crania. The crania, for convenience in study, have been ranged in three classes as follows: brachycephalic, with indexes above 80; mesaticephalic, with indexes between 75 and 80; and dolichocephalic, with indexes below 75.

It is not possible in a preliminary report of this kind to describe at length each skull or give the various minor measurements. Type skulls of each group will, therefore, be taken.

Specimen 4503, a male taken from burial 5. This skull is the best preserved of any found and is the heaviest, weighing 24 ounces. It is that of a person of mature years, between 50 and 60. The teeth which remain are well preserved, but there are cavities in the superior right canine and in the adjoining premolar. On the right side in the upper jaw the molars are entirely lacking and the matrices filled. The third molar on the left seems to have been lost a short time before death. The first premolar on the left is abnormal in that it grows out at an angle. This has resulted in it being worn obliquely and protruding over the premolar beneath. On the opposite side the premolar is normal in form, but between it and the canine there is a supernumerary tooth. The denture of the lower jaw is normal and there are no cavities in the teeth which remain. On the left side all the premolars are gone and the matrices healed and closed. On the right side one molar and the other teeth remain.

The inferior maxillary is well preserved. It is remarkable for the squareness of the chin, the mental tubercles on either side being pronounced. They flare out from the body of the maxillary and give the chin a width of 57 millimeters.

The sigmoid notch is crescentic and not parabolic. In breadth, measuring from the crests of the coronoid processes, the jaw is 107 millimeters, and a line drawn from a point midway between the angles to the point of the chin gives a length of 70 millimeters.

The palate is worthy of note because of its several peculiarities. The transverse suture has entirely united and several spinous processes have formed on each side of the sagittal suture. The posterior palatine canal on the right is larger than that of the left due to the absorption or the retarded growth of the septum. These

Plate 41



Two views of skull 4503, from grave 6, McCullough site. Breadth index, 71.6

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canals are not normal in form. The external base of the skull presents several other interesting features, one of which is the form of the *foramen magnum*.

An examination of the upper portion of the skull shows that the sutures have begun to amalgamate. This is especially noticeable in the coronal suture where it disappears after touching the temporal ridge. On the left side, however, there is an excrescence formed by two spinous processes that arise a millimeter above the plane of the alisphenoid. These excrescences are thin and calcareous and appear to be the result of an injury.

The supraciliary ridges are heavy and their surface covered with fine convolutions. The frontal bone slopes back and the forehead is low. The occipital region is full but asymmetric, the left side being larger. The nasal bone curves sharply out from the face lifting *rhinion* above the plane of *dacryon*. This suggests a wide and prominent proboscis which must have appeared in life formidable as accentuated by the beetling brows. The whole appearance of the skull with its many ridges indicates an extraordinary musculature. A list of the principal rectilinear measurements follows:

Maximum length, 187 mm	Basi-prosthionic length, 98 mm
Maximum width, 134 mm	Nasi-prosthionic length, 76 mm
Basal height, measured from basion to bregma, 141 mm	Bi-zygomatic breadth, 137 mm
Auricular height, 120 mm	Bi-stephanic, 118 mm
Horizontal circumference, 525 mm	Orbital height, 38 mm
Auriculo-nasal length, 95 mm	Orbital width, 45 mm
Auriculo-prosthionic length, 100 mm	Nasal height, 55 mm
Basi-nasal length, 108 mm	Nasal width, 26 mm

INDEXES

Part	Measurement	Decimal Indexes	Classification
Breadth	134	71.6	Dolichocephalic
	187		
Height	141	75.4	Metriocephalic
	187		
Alveolar	98	90.79	Orthognathous
	108		
Nasal	26	47.3	Leptorrhine
	55		

59 1693

Part	Measurement	Decimal indexes	Classification
Facial	<u>76</u> 137	48.1	Chamaeprosopoe
Stephano-zygomatic	<u>118</u> 137	86.1	Phenozygous
Orbital	<u>38</u> 45	84.4	Mesosmic

Capacity 1649.2 ccm

Specimen 4550; an adult mature male. The facial portion is missing and was probably lost during the process of ossuary burial. The sutures are distinct but the coronal is in an advanced stage of synostosis. On either side this suture is not visible below the temporal ridge except for a centimeter on the right side. The left orbit has a wide supraorbital notch which the right does not present. The supraorbital ridges are similar to those on the other male skulls and the glabella full. The frontal dome slopes back and there are no eminences. On the right side of the temporal, the squamous suture has united posteriorly with the parietal for a distance of 25 millimeters. On either side the alisphenoid has united with the parietal. On the right the temporal ridge is not well developed although on the left it is plainly visible. There is a Wormian bone at the point of union between the parietals and the occipital bone, and two a centimeter above the point where the superior temporal line touches the lambdoid suture.

Below are enumerated the principal measurements possible in this specimen.

	Millimeters		Millimeters
Maximum length.....	185	Basion-nasion.....	109
Maximum breadth.....	140	Bi-stephanic.....	113
Basion bregma.....	140	Auricular hight.....	125
Circumference.....	510		

The only indexes possible follow:

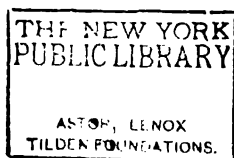
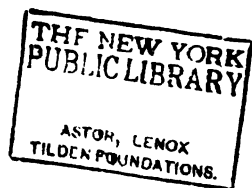
Part	Data	Index	Classification
Breadth	<u>140</u> 185	75.5	Dolichocephalic
Hight	<u>140</u> 185	75.5	Metriocephalic

Capacity 1531.7 ccm

Plate 42



Two views of skull 4548 from ossuary. Index, 77.7



Specimen 4548; a mesaticephalic female skull found in ossuary 9. It is in a fair state of preservation although it is very fragile. It is that of a female of perhaps mature years. The teeth are entirely lacking, those on the upper jaw having undoubtedly been lost during the process of reinterment. In the lower jaw the canines and incisors were the only ones remaining at the time of death. The matrices of the other teeth have closed. Upon the cranium, the sutures though distinct have lost their intricacies, but none of the bones have affected synostosis.

The measurements in millimeters of this specimen follow:

DIMENSIONS			
	Millimeters		Millimeters
Maximum length.....	175	Basi-prosthionic length.....	170
Breadth.....	136	Bi-zygomatic breadth.....	136
Basal height.....	132	Bi-stephanic breadth.....	111
Circumference.....	502	Orbital height.....	37
Auricular height.....	120	Orbital width.....	41
Auriculo-nasal length.....	89	Nasal height.....	50
Auriculo-prosthionic length.....	98	Nasal width.....	25
Basi-nasal length.....	106		

These measurements give the following indexes of proportions:

Part	Data	Index	Classification
Breadth	$\frac{136}{175}$	77.7	Mesaticephalic
Height	$\frac{132}{175}$	77.4	Metriocephalic
Aveolar	$\frac{95}{102}$	93.1	Orthognathous
Nasal	$\frac{25}{50}$	50	Mesorrhine
Facial	$\frac{71}{136}$	52.9	Leptrosope
Stephano-zygomatic	$\frac{113}{136}$	83	Phenozygous
Orbital	$\frac{37}{41}$	90.2	Megasemic

Capacity 1437 ccm

Specimen 4554; female skull, brachycephalic in form. Almost the entire top has been destroyed by the pressure of the superincumbent earth, but not enough to prevent most of the measurements. Only three teeth remain, the others having been lost in process of reburial. The palate is wide, having a length of 50 millimeters and a width of 42, which gives an index of 84.

The orbits of this skull differ from most of the others. They more nearly approach a circular form and have no angles at the turns.

	Millimeters		Millimeters
Length	163	Orbital high	38
Breadth	133	Orbital width	42
Nasion to prosthion	72	Bi-zygomatic breadth	133
Nasal length	48	Basion to prosthion	98
Nasal width	26	Basion to nasion	102

These measurements give the following indexes:

Part	Data	Index	Classification
Breadth	$\frac{133}{163}$	81.6	Brachycephalic
Alveolar	$\frac{98}{102}$	96	Orthognathous
Nasal	$\frac{26}{48}$	58.3	Platyrrhine
Orbital	$\frac{38}{42}$	95	Megasemic

Capacity indeterminate

Femora. There are a number of morphological variations in the collection of femora which command attention at once. The more striking anomalies only will be mentioned here. They are those termed the third or supernumerary trochanter and platymeria. Each of these characters is found in a large percentage of the femora, the supernumerary trochanter in about 40 per cent and platymeria in 60 per cent. For the several variations which these femora present a brief description of several is here appended.

Specimen 4522; right femur, probably male, weighs $9\frac{1}{2}$ ounces. It is heavily built and has a heavy gluteal ridge for a distance of 6 centimeters below the lesser trochanter. The superior extremity is normal (Indian) though the digital fossa is deep.

Plate 43



Two views of skull 4551. Index, 76.6

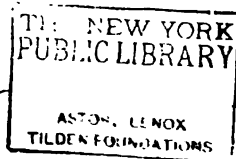
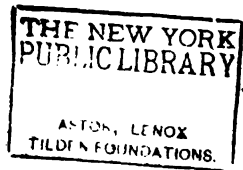


Plate 44



Two views of skull 4552. Index, 74.1

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There is a tuberosity of slight elevation resembling a third trochanter and below it and extending within 35 millimeters in a diametrical plane of the superior arterial foramen is the hypotrochanteric fossa. Its depth is accentuated by a flangelike projection of the shaft. The femur is not especially platymeric, index 74.3.

The lower portion of the femur is apparently normal although the external tuberosity is large, but this seems a characteristic of many of the femora.

Specimen 4505; a typical shaft. It is 428 millimeters in length and weighs $10\frac{1}{2}$ ounces. In color it is a straw yellow and like all the other bones bears no sign of fossilization. The neck is long and the ball bears a deep lozenge-shaped fossa of the interarticular ligament. The *linea aspera* is heavy and above the arterial foramen becomes the gluteal ridge, the width of which is accentuated by the flangelike projection on the anterior border of the shaft. Above this ridge is the third or supernumerary trochanter. The sagittal diameter of the shaft is 24 millimeters and the transverse 34, which gives the platymeric index 70.6.

Specimen 4516; a short heavy femur with a length of 435 millimeters and a weight of 11 ounces. The upper portion is heavy and abnormal in several characters. The neck is short and the great trochanter heavy. These characters give the upper portion of the femur a wide, heavy appearance and the upper part of the head or ball rises scarcely a centimeter above the top of the great trochanter. The portion of the ball surrounding the fossa of the interarticular ligament is flattened and the fossa is small. On the internal side of the ball at its juncture with the neck there is a depression 12 millimeters in length and a millimeter wide. The digital fossa is deep, wide and filled with small tubercles. The cavity reaches down along the intertrochanteric ridge to the lesser trochanter. The shaft is not platymeric.

Specimen 4513; a large shaft, probably male, with a length of 470 millimeters and a weight of 11 ounces. It is noticeably platymeric and has an index of 63.1. Part of the great trochanter is broken and with it the upper part of the external border of the shaft. An elevation in the bone just where it is broken seems to indicate that a third trochanter had been broken off.

~ **Tibiae.** One of the peculiarities of the tibiae which is at once apparent to the most superficial observer is the transverse flattening of the tibial shaft which gives it a saberlike appearance. This anomaly is present in 75 per cent of the tibiae from Gerry and

therefore must be regarded as a character normal to the race. The platycnemic tibiae are all those of adults, those of adolescents being less pronounced. The indexes taken from specimens range as follows:

Number	Length	Diameters	Index
4540	broken	20 -39	51.3
4700	broken	19 -34	55.8
4546	broken	23 -39	56.4
4536 B	390	21.5-38	56.6
4536 A	381	21.5-38	56.6
4538	402	23 -38	60.5
4541	376	22 -36	61.1
4542	355	22 -36	61.1
4544	367	22 -35	62.09
4543	398	25 -38	68.4
4547	336	24 -33	72.7
4545	365	24 -33	72.7

Humeri. An examination of the humeri from the Gerry site revealed a percentage of 40 with the perforated olecranon cavity. In the Edson-Reed donation from the Dennison site are 19 humeri, 12 perforated and 7 nonperforated. This gives a percentage of 58.3 perforated. The tibiae from the site are greatly flattened, some giving an index of $18\text{mm}-35\text{mm} = 51.7$. That the perforations are natural and not due to a decay of the septum is patent from a microscopical examination of the edges of the perforations where the external osseous surface appears unbroken. In some of the nonperforated specimens the osseous septum is of tissue thinness and is translucent when held to the light. Where one of these has become broken the fracture line is radically different from the border of natural perforation. Some superficial investigators have endeavored to explain these perforations by the disappearance of the septum by decay, but even a hasty examination fails to justify this assumption.

Artifacts. Pottery. The specimens of pottery secured in the Cassadaga valley consist entirely of fragments. Several crushed pots, however, may be restored. In thickness this pottery is less than that from the shore of Lake Erie. It is mostly tempered with pulverized shell and is comparatively light in weight. The incised designs are few and simple in character and are of the early Iroquoian style. Nearly all the specimens were found in ash pits, although a few fragments were found in a grave filling.

Plate 45



▼ Platymeric femora. The third trochanter is especially noticeable in the third and fourth specimens.

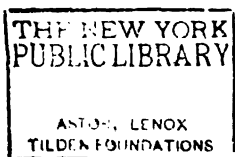


Plate 46



Platynemic tibiae from the McCullough site. The fourth tibia has an index of 54.

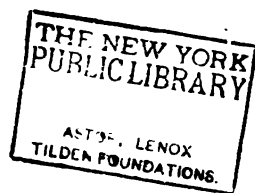


Plate 47



▼ Perforated humeri from the McCullough site, Gerry, N. Y.

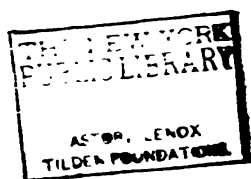
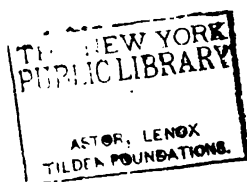


Plate 48



Humeri from the Dennison site. All but the last two have the olecranon fossa perforated.



Stone objects. Articles of stone were not numerous and at the Gerry site only three celts were found and these outside the inclosure on the higher ground.

No hammer stones or anvils were found but arrow chippings and triangular flint points were fairly numerous.

Bone objects. No bone implement or object of any description was found in the village site and the only bone object found whatever was the heron bill near the forehead of the male skeleton in grave 6.

Sites examined

A list of the earthworks and village sites examined in Chautauqua and Cattaraugus counties follows. From two to five days or more were spent in the examination of each in order to determine their character and the culture represented.

1 An earthwork situated on a bluff at the confluence of a small brook with Mill creek is described by the old inhabitants as a circular work with a deep depression in the center. This is situated on the Margaret Harris farm. No part of the earth wall remains although the excavation in the center is yet visible. It however seems natural rather than artificial. Few traces of occupation could be discovered although several days were spent in testing and excavating. Some flints and fire-cracked stones were strewn on the bank above Mill creek, but there were no pits or pottery.

This work is mentioned in State Museum bulletin 32, *Aboriginal Occupation of New York*, as no. 24 in Chautauqua county.

2 There was an extensive earthwork and village site in the heart of the village of Sinclairville. Cheney's plan and description are erroneous. The site was examined and a map made from an actual survey by Hon. Obed Edson of Sinclairville. This earthwork belongs to the prehistoric Huron-Iroquois, and triangular points and pottery are found each year as the lawns are graded and gardens tilled.

3 **The Edmunds site.** An interesting camp site, discovered on Pine hill is situated on the Edmund's farm in the town of Charlotte. 27 pits were opened here and a quantity of pottery found. Two crushed pots were found in pits on the nose of a sandy projection that ran out from Pine hill into the valley of Edmund's brook. One large pit had a stoned floor and was walled with slabs of shale. This was evidently a cache or storage cellar. The Edmund's site is about one mile from Cassadaga creek and is situated between the Dunkirk, Allegany Valley & Pittsburgh track

and the Dunkirk road. At the foot of the hill just above the little flat washed out by the brook a large ash bed was discovered. This ash bed is 27' by 47' in dimensions and 36" deep. It was filled with carbonized material and disintegrated sandstone and drift boulders. Several of these large ash beds were examined in the locality but nothing which would give a clue as to their purpose could be discovered.

4 The Dennison site in the township of Gerry lies about a quarter of a mile from the Charlotte township line. It is crossed by the old Chautauqua road, but now may only be traced by careful examination. This work was explored and partially excavated in 1887 by Hon. Obed Edson of Sinclairville who donated to the museum some of the human remains which he had taken from a large ossuary here. The site is of the early Iroquoian type and no occupied soil could be discovered.

5 A site on which a group of 12 pits are still visible is situated on the Sears farm near the site previously described. Nothing could be discovered in the pits although all were excavated.

6 The McCullough site on Gerry hill has already been described at length.

7 A glacial kame near Cassadaga lake has a row of pits across the top. These were opened, but nothing except a few kernels of charred corn, a few flint chips and fire-broken stones remains to tell of their Indian origin.

8, 9, 10 Three places near Cassadaga lake were examined. All were old sites of early Iroquois culture.

11 At the head of Cassadaga lake upon the dividing ridge of the watershed a small camp site was discovered.

12 An interesting ash bed situated on the H. Carlson farm in lot 46, Gerry, was examined. This bed is upon a little promontory that juts out into the valley of a small stream sometimes called Phelps pasture brook and is easily discovered by the low mound of black earth which rises a foot or two above the surrounding surface.

The bed is 40' by 45' in dimensions and 4' deep. It is composed of a light sandy soil intermixed and colored black by large quantities of pulverized carbonaceous material. Large numbers of sandstone blocks and granite boulders cracked and crumbling are distributed through the mass. A large white pine stump $\frac{1}{2}$ feet in diameter crowns the bed so that the work is plainly not that of white people. Numbers of these ash heaps are found throughout the county and form a problem yet to be solved.

13 One of the largest earthworks in Chautauqua county was situated on the old Partridge-Harris farm in the village of Gerry. The wall of this work has been plowed down but originally inclosed an area of about six acres. Excavations here revealed deep disturbances, but none of the pits contained bone objects nor pottery in any quantity. Hammerstones, celts, potshēds, arrowheads and a pipe stem were found in the occupied layer.

14 Some most interesting sites are to be found in the valley of Clear creek in the township of Ellington. The "Old Fort" in Ellington village is one of the most notable in Chautauqua county. Several days were spent here examining the inclosure for pits and burials. Several large ash pits were opened and a quantity of pottery and a dozen arrow points, triangular type, were found. The culture is early Iroquoian and prehistoric.

The earthwork is oval in form with a gate at the eastern end. It is situated upon a steep hill which runs out into the valley and as a strategic position is almost ideal. An examination of the map herewith presented demonstrates this fact.

15 The Boyd site is situated near the line of lots 47 and 39 in Ellington and is found upon a level plateau which forms the edge of a stream-cut terrace just above the valley of Clear creek. This fort was described by T. A. Cheney in the 5th Annual Report of the State Museum, but his survey does not appear entirely accurate.

No deep pits were found here and the occupied layer was thin. Culture: Early Iroquoian, prehistoric.

16 Opposite this site upon the terrace on the opposite side of the valley, 1700 feet distant, is another earthwork. This work, however, is a circular one. Excavation revealed that it was of the early Iroquoian culture with triangular arrow points and early pottery. No long occupation.

17 A circular fort in the town of Clear Creek had a large central pit but was not available for excavation.

18 Between the "Old Fort" and Ellington and the Clear Creek fort is a glacial kame which contains what appear to be old burials. Here notched and shouldered points and a gorget were found.

19 Several small camp sites were visited and examined in Conewango in Cattaraugus county.

20 A site on the Marshall farm in Sherman.

21 A mound at Findley lake on the Hill farm.

22 Large pits in numbers at the head of Findley lake.

23 Pits in Kennedy near the Randolph town line.

- 24 A large mound on the Cheney farm in Poland.
- 25 Two mound sites at Falconer.
- 26 An old burial site in Victoria on Chautauqua lake.
- 27 Two mounds at Vandalia, at the confluence of Chipmunk creek and the Allegany river.
- 28 The sites of the mounds at the mouth of Olean creek.
- 29 Mound on the Sunfish property in Great Valley.
- 30 Earthwork site at Point Peter on Cattaraugus creek.
- 31 Village site in Elko.
- 32 Burial site at Old Town in Elko.
- 33 Village site at Onoville on the Allegany.
- 34 Village site on the banks of Clear creek in Erie county.
- 35 Earthwork on Zoar hill in Otto.
- 36 Earthwork on the McNeil farm in Westfield.
- 37 Village and burial site on Chautauqua creek, Westfield.
- 38 Two fort sites on the Almey farm in Gerry.
- 39 Earth ring site and occupied kame 40 rods distant from 38.
- 40 Site at High Banks near Irving.
- 41 Silverheel's site on the Cattaraugus reservation. Probably early Seneca.

Excavations conducted here by the owner of the property yielded some interesting specimens of entire pottery and bone objects. These objects will be acquired for the State Museum.

The results of the examination of the foregoing sites are reserved for fuller description. Two important facts may here be stated with propriety.

1st, That the Senecas occupied western New York west of the Genesee, having fixed villages long before the Revolutionary War. The date of these sites may be fixed shortly after 1656. This fact is supported alone by the testimony of archeology and the evidence is too overwhelming to be disputed.

2d, That the Senecas in western New York, west of the Genesee, made pottery and flints at the same time when they used European articles extensively. Iron, glass, broken china ware, flint chips, broken pottery and bone implements have all been found in the same pits.

Notable accessions

- * **Wampums.** A wampum belt 22 inches long and 8 rows wide was purchased from W. C. Hill of New York city. The design

consists of six diagonal bars of white beads, three bars on each side of a central cross, the arms of which radiate from a central square composed of eight white beads. The beads are strung on a vegetable twine, probably hemp.

The belt is said to have come from Oldtown, Maine, where it had been held by the Penobscot Indians. It is said to be of Iroquois manufacture and to be a "condolence belt." It is a command and summons to a condolence council at Onondaga, represented by the central cross.

A wristband of modern stringing is another wampum piece of interest. It is said to have been an old Mohawk wristband which has been restrung to preserve the design, the original warp having decayed and become broken.

The Archeologist secured on the reservations several ceremonial wampum strings of considerable interest. One is a string of purple beads hung from a streamer of black ribbon in five strands of thirty-two beads each. At the end of each string is a small piece of deer-skin. This wampum is said to have been a Seneca condolence string, that is a string used in the ceremony of a mourning council. Another string of purple wampum divided in two strands is represented as the "death horns." It was held by a sachem until his death when it was passed to his successor in office as a symbol of name and office.

A string of mixed purple and white beads arranged in two strands is a "name." One strand consists of beads arranged as follows: 2 purple, 1 white, 2 purple, 1 white, 2 purple, 2 white, 4 blocks the same, then 5 purple, 2 white, ending with 1 purple bead held on the string by a small knot of yellow ribbon. The other strand consists of bars of 4 purple beads with a white bead interposed between. A faded purple ribbon holds the beads on the linen string.

A "runner's" or messenger's summons composed of 50 purple beads strung on gut and tied to a notched stick is a condolence council call. There are four notches on the stick which mean that four days' time is given in which to appear at the council.

A Canadian string of mixed disk wampum and colored beads forms an interesting mate of the disk string secured in 1898 by Mrs H. M. Converse. The string is strung on heavy cotton thread and there are knots of colored ribbon tied at intervals. Mr M. R. Harrington who secured this piece says that it is the last Tutelo name string and obtained with great difficulty. The Tutelos are an adopted captive tribe originally of Siouxan culture.

Silver ornaments. The Archeologist secured nearly a hundred silver brooches of various sizes from the Allegany Senecas. These brooches are of various sizes and forms and furnish a valuable addition to the State collection.

A collection of 19 large silver disks ranging from 6 inches in diameter down to 2 inches was included in the Hill collection. These disks are represented as Algonquin ornaments secured at Oldtown, Maine. In this collection were two silver crowns one of which is the largest in the State collection.

Some rare brooches were included in the M. R. Harrington collection. In this collection also was a pair of earrings very similar to those figured by Morgan in the early Museum reports.

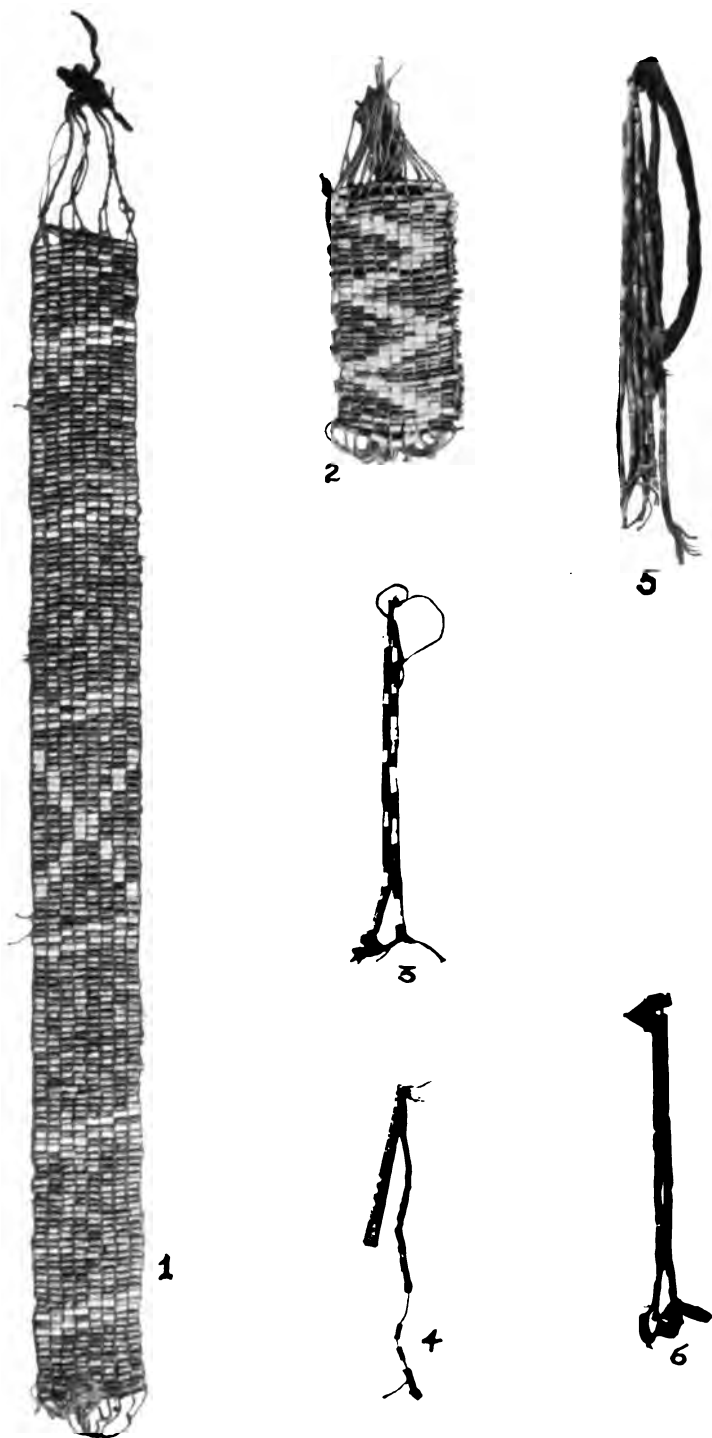
Several pairs of silver earrings of interesting form were purchased from the Indians by the Archeologist. Some of the specimens have glass gems in settings.

Possibly the most valuable ethnological acquisition was a set of Indian silversmith's tools, purchased from a brother of the last Allegany brooch maker, George Silversmith. The outfit consists of small iron and steel chisels, made by the silversmith himself. A massive blowpipe of brass, store hammers and files were included. The silver used for brooch making was obtained by beating Canadian silver coins to the desired thinness when the pattern was traced on and cut out with the chisels. A set of earring and ring punches form an important part of the outfit.

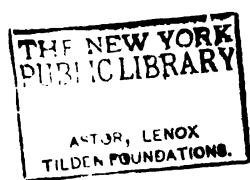
Several Indian made finger rings were also acquired and are the only specimens in the State collection.

Masonic emblem. One of the most interesting specimens of the white man's art found on an Indian site is a large Masonic emblem of copper found by Luke I. Fitch on an old Onondaga site near Pompey, Onondaga co. The square and compasses in the emblem are surrounded by a belt embossed with the roses of York and the Scottish thistles. Several Iroquois Indians late in the 18th century and early in the 19th were Free Masons, notably Brant and Red Jacket. Whether the emblem was worn by some Indian or by a white man is not known, but the probabilities are that it was lost by some colonial soldier or agent sent among the Onondagas.

Several Masonic brooches of Indian make are in the museum collection of Iroquois silver work.



Wampum articles acquired during 1907
 1 Council belt. 2 Wrist band. 3 Name string. 4 Messenger's summons.
 5 Condolence wampum. 6 Chief's horns





1



2



3



4



5

Metallic ornaments acquired during 1907
1 Silver head band. 2 Silver brooch. Pattern conventionalized from
Masonic emblem. 3 Masonic emblem in copper from village site near Pompey.
4 Algonquin disk brooch in silver. 5 Seneca brooch in silver.

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VII

A STATE HISTORICAL MUSEUM

Section 22 of the University Law as amended to 1904 reads in part as follows:

State Museum: how constituted. All scientific specimens and collections, works of art, objects of historic interest and similar property appropriate to a general museum, if owned by the State and not placed in other custody by a specific law, shall constitute the State Museum.

The State of New York has made provision for the acquisition and preservation of historical records but these only in the form of documents, written or printed, of which the State Library has now become a vast treasure-house. The Bureau of Military Statistics pertaining to the department of the Adjutant General has brought together by voluntary cooperation an extensive store of military relics, in very large part memorials of the Civil War; the State Historian is authorized by law to "collect, collate, compile, edit and prepare for publication all official records, memoranda and data relative to the Colonial Wars, War of the Revolution, War of Eighteen Hundred and Twelve, Mexican War and War of the Rebellion, together with all official records, memoranda and statistics affecting the relations between this commonwealth and foreign powers, between this State and other States and between this State and the United States." He is not empowered to acquire other historical materials than the data above referred to, nor has he authority of law or appropriations to acquire historical "objects" as distinguished from records, memoranda and documents. There is thus no department of the State which has adequate authority, breadth of scope and available funds for acquiring and conserving "objects" of historical importance, in distinction from historical "documents," except the Education Department through the agency of the State Museum.

Importance of a State historical museum

Throughout the history of the commonwealth no systematic effort has ever been made on the part of the State to conserve the relics of its history. In the early career of the State Museum a good many objects pertaining to the early culture of the community came into its possession, but in the development of the museum,

materials regarded as of more purely scientific character were considered as the proper field of the institution and its activities in acquisition were restricted to that scope. The sphere of its functions is now broadened by the University law above cited.

The State has shown an appreciative spirit and most laudable activity in the acquisition or protection of places with historic associations. With or without volunteer private cooperation, it has taken over historic property, marked with commemorative monuments sites of momentous and critical events in its history, raised imposing memorials on its battlefields and statutes to some of its distinguished sons. The spirit which has inspired these results has been born and nursed into expression by a multitude of patriotic societies, some of general, others of more local scope. But further than this in the conservation of its historical materials the State has not gone. It has left wholly to local civic associations the conservation of the relics of its history. There is scarcely an intelligent community in the State which has not an historical society engaged not merely in retelling the often half remembered story of local events but conserving the materials associated with the early stages of its progress and the personal careers of its distinguished citizens.

It would be impossible to estimate the value of the collections of these societies to the student of New York history and the edification, satisfaction and pride with which these are contemplated by the citizens of this State. But these results have been achieved alone by private organizations moved by the same proper spirit which may justly require of the State that it conserve the monuments of its own cultures.

If there is ever to be a State Historical Museum certainly it is time to inaugurate it and if the effort is made it should be made persistently, with a clearly defined purpose in view. Time is passing. New York has behind it 300 years of successive cultures and back of that the cultures of the aborigines. It is no longer easy to acquire the relics of these cultures. In another generation they will all have passed into the possession of public or private museums.

It is with the relics of the different settlements rather than with its critical events that an historical museum should concern itself. Such collections of historical objects should depict in the truest and most realistic fashion the modes and means of living in each successive phase of culture, should reproduce by proper association a faithful picture of domestic life and habitudes. The educational

value of such demonstrative collections would be of high quality and an essential supplement to the training of the schools.

New York need not, because of its relative youth, invite the difficulties which have confronted other countries with longer histories, in the formation of historical museums. The making of such collections has always been too long deferred. But New York may well follow the example and hope for the results which other nations have achieved in this direction, for in all the countries of Europe are no collections of whatever character of so general interest and instructiveness to the public as the Historical Museums such as those of Amsterdam, Hamburg, Berlin, Nuremberg, Zürich and Basel.

Plan for a State historical museum

There is a vast difference between a miscellaneous assortment of historical objects, each out of its proper association with only its individual story to tell or its personal associations to invite attention, and an historical museum scientifically arranged with its objects all brought into their proper historic perspective. There are thousands of valuable historic relics in local collections of the State, which must by the very nature of the conditions under which they are brought together be left to tell their story as best they can by themselves. There is but one method however in which such objects can be made adequately to present their full significance and that is the method of proper association. As an outline of what a State historical collection might be the following suggestions are made.

In general, a portrayal of the successive or contemporaneous cultures in this State by a reproduction of the mode of life and dress in the various phases of our civilization. For such purposes a series of rooms assigned to the various cultures would display

- 1 The domestic life of the aborigines: an Indian lodge appropriately equipped with the daily utensils of the aborigines, the squaw at the hand-mill; the potter molding clay vessels and pipes, the brooch maker and the arrow maker with their equipments. It would be vastly to the credit of a State like New York, the home of the Iroquois Confederacy, the earliest and mightiest of all aboriginal leagues, the seat of momentous events in Indian and frontier history, the founder and supporter of the State Museum which is the possessor of priceless and unexampled collections of Iroquois culture relics and the official custodian of the archives of the Six Nations, to go still further into the realistic portrayal of Indian life

and customs by the reproduction of certain important ceremonials and councils of which there remain today but stories on printed pages. New York could afford to keep this romantic period of its history before the eye and transmit it in reasonable fulness and force to posterity.

2 The domestic life of the Dutch culture, represented by one or two rooms, say a living room and kitchen equipped with the utensils and materials appropriate to the period of the Dutch settlement.

3 Some portrayal of the German culture of the upper Hudson, Schoharie and Mohawk valleys — a culture which though transient left a recognizable impress on the community. Also of the Huguenot settlements in Ulster county and the lower Hudson valley.

4 Rooms equipped with the furnishings of the English colonial revolutionary period before the invasion of the French influence.

5 An adequate representation of life on the frontier of Central Western New York before the extinction of the Indian land titles and the Massachusetts claims.

Such a carefully coordinated collection would naturally be supplemented by other materials which could not be placed in such associations but would help to complete the portrayal of past cultures.

In the geological department of the State Museum an earnest effort is being made to bring together materials which will demonstrate the historical development and present working of such industries as depend upon the natural mineral resources of the State. In this undertaking a willing and appreciative cooperation with the producers of the State has been elicited. With the very best reason the State Museum may hope for an equally zealous cooperation of the citizens in the formation of an historical collection.

There are still to be had from the descendants of the older families of this State many historical relics; few are treasured, more are not. Some are merely harbored for their associations, many are lying in garrets and barns. An appeal to the patriotic instinct coupled with an assurance that such relics if placed in the State's custody will not only never be deprived of their personal associations, but be placed in their proper surroundings, should not fail to be effective.

It is submitted that such an historical collection as is here outlined for New York should exist and that the acquisition of such materials by the State should not be delayed. There is no historical collection in America arranged on such a basis as here suggested.

VIII

PUBLICATIONS

A list of the scientific publications issued during the year 1906-7 with those now in press and treatises ready for printing is attached hereto. The publications issued are 14 in number on a variety of topics covering the whole range of our scientific activity. They embrace 2472 pages of text, 213 plates and 38 maps (3 colored).

The labor of preparing this matter, verifying, editing and correcting is onerous and exacting. Taken altogether it excellently indicates the activity and diligence of the staff of this division.

Annual report

- 1 Third Report of the Director, State Geologist and Paleontologist for the fiscal year ending September 30, 1906. 186p.

Contents:

- | | |
|--|--|
| <p>I Introduction
Condition of the scientific collections constituting the State Museum</p> <p>II Report on the geological survey
Geological survey
Mineralogy
Earthquake records
Limestone caverns of eastern New York
Paleontology
Special problems</p> <p>III Report of the State Botanist</p> <p>IV Report of the State Entomologist</p> | <p>V Report on the zoology section</p> <p>VI Report on the archeology section</p> <p>VII Publications</p> <p>VIII Staff of the Science Division and State Museum</p> <p>IX Accessions</p> <p>X Appendixes
A Localities of American Paleozoic fossils
B Type specimens of Paleozoic fossils. Supplement 3</p> |
|--|--|

Memoirs

- 2 No. 8 Insects Affecting Park and Woodland Trees. By E. P. Felt. v.2, 548p. 22pl.

Contents:

- | | |
|---|---|
| <p>Enemies of evergreen or coniferous trees
Work of bark borers in pine
Certain structures of scolytids</p> <p>Borers
Twig borers
Ambrosia beetles
Leaf feeders</p> <p>Insects of minor importance affecting forest trees
Insects affecting deciduous trees
Borers in living or relatively sound wood or bark
Borers in dried, usually manufactured wood
Borers in decaying wood or species found under decaying bark</p> | <p>Insects of minor importance affecting forests trees (<i>continued</i>)
Fungous beetle
Natural enemies of bark borers
Leaf eaters affecting deciduous forest trees
Frequenters, usually injurious, of deciduous forest trees
Frequenters, usually beneficial, of deciduous forest trees
Plant galls and gall makers
Less destructive insects affecting evergreen or coniferous trees
Supplemental bibliographic and descriptive catalogue
Explanation of plates
Index</p> |
|---|---|

- 3 No. 10 The Devonian Fishes of the New York Formations.
By C. R. Eastman. 236p. 15pl.

Contents:

Introduction
Conspectus of species, arranged
according to their geological oc-
currence
Tabular key to systematic descrip-
tions
Systematic account of Devonian
fishes, principally from New
York and Pennsylvania

Summary and conclusions
Zoological conclusions
Geological conclusions with re-
marks on the distribution of De-
vonian fishes
Explanation of plates
Index

Bulletins

Geology

- 4 No. 106 Glacial Waters in the Lake Erie Basin. By H. L.
Fairchild. 88p. 14pl. 9 maps.

Contents:

Introduction
Literature
Area. Maps
Geography. Topography
Outline of glacial history
Ice margins; moraines

Glacial drainage channels
Local glacial lakes
Greater glacial lakes
Shore lines of the greater lakes
Deltas and lake plains
Index

- 5 No. 107 Geological Papers. 388p. 56pl. 1 map.

Contents:

Postglacial Faults of Eastern New
York. J. B. WOODWORTH
Stratigraphic Relations of the
Oneida Conglomerate. C. A.
HARTNAGEL
Upper Silurian and Lower Devonian
Formations of the Skunkemunk
Mountain Region. C. A. HART-
NAGEL
Minerals from Lyon Mountain,
Clinton County. HERBERT P.
WHITLOCK
On Some Pelmatozoa from the
Chazy Limestone of New York.
GEORGE H. HUDSON

Some New Devonian Fossils. JOHN
M. CLARKE
An Interesting Style of Sandfilled
Vein. JOHN M. CLARKE
The Eurypterids Shales of the
Shawangunk Mountains in East-
ern New York. JOHN M.
CLARKE
A Remarkable Fossil Tree Trunk
from the Middle Devonian of New
York. DAVID WHITE
Structural and Stratigraphic Fea-
tures of the Basal Gneisses of the
Highlands. CHARLES P. BERKEY
Index

- 6 No. 111 Drumlins of Central Western New York. By H. L.
Fairchild. 58p. 28pl. 19 maps.

Contents:

Introduction: general description
Areal distribution
Orientation
Relation to larger topography
Relation to underlying rock strata

Form and dimensions
Dimensions
Composition and structure
Roc drumlins
Concentric bedding

Contents:

Formation: theoretical mechanics
a Dynamic factors pertaining
 to the ice body
b Factors relating to the drift
 held in the ice
c Factors of external control
 Drumlin forms and observed re-
 lations
 Relation to moraines
 Special features
 Syracuse island masses
 Montezuma island groups
 Nondrumlin areas; open spaces

Special features (*continued*)
 Channels among the drumlins
 Summary
 Age of the drumlins
 Thrust motion of the ground
 contact ice
 Origin
 Dynamics
 Drumlin forms
 Depth of the drumlin-making ice
 Drumlins of Ireland
 Bibliography
 Index

- 7 No. 115 Geology of the Long Lake Quadrangle. By H. P. Cushing. 88p. 20pl. 1 map.

Contents:

Acknowledgment
 Situation and character
 General geology
 Rocks
 Rock structures

Topography
 Glaciation
 Economic geology
 Petrography of the rocks
 Index

- 8 No. 112 Mining and Quarry Industry of New York. 3d report. By D. H. Newland. 82p.

Contents:

Preface
 Introduction
 Mineral production of New York
 in 1904
 Mineral production of New York
 in 1905
 Mineral production of New York
 in 1906
 Iron ore
 Notes on recent mining develop-
 ments
 Millstones
 Mineral paint
 Natural gas
 Arsenical ore
 Carbon dioxid
 Cement
 Clay
 Manufacture of building brick
 Other clay materials
 New manufacturers of clay ma-
 terials
 Pottery

Clay (*continued*)

Crude clay
 Emery
 Feldspar
 Garnet
 Graphite
 Gypsum
 Peat
 Petroleum
 Pyrite
 Quartz
 Salt
 Sand-lime brick
 Slate
 Stone
 Granite
 Limestone
 Marble
 Sandstone
 Trap
 Talc
 Zinc and lead
 Index

Paleontology

- 9 No. 114 Geologic map of the Rochester and Ontario Beach
Quadrangles. By C. A. Hartnagel. 38p. 1 map.

Contents:

Introduction
Sequence of events preceding the
deposition of the rocks of the
Rochester area
Formations
Medina formation

Formations (*continued*)

Clinton formation
Niagara formation
Salina formation
Index

Entomology

- 10 No. 109 White Marked Tussock Moth and Elm Leaf Beetle.
By E. P. Felt. 34p. 8pl.

Contents:

Introduction
White marked tussock moth
Description
Life history and habits
Food plants
Natural enemies
Remedies
Elm leaf beetle
Food plants

Elm leaf beetle (*continued*)

Distribution
Description
Life history
Natural enemies
Remedial measures
Explanation of plates
Index

- 11 No. 110 Report of the State Entomologist for the fiscal year
ending September 30, 1906. 152p. 3pl.

Contents:

Introduction
Fruit tree insects
Shade tree problem
Gipsy and brown tail moths
Aquatic insects
Gall midges
Publications
Collections
Office work
Nursery certificates
Voluntary observers
General
Notes for the year
Fruit insects

Notes for the year (*continued*)

Garden insects
Shade tree insects
Forest insects
Miscellaneous
Voluntary entomological service
List of publications of the Entomologist
Contributions to collection
Appendix
New species of Cecidomyiidae
Addenda
Explanation of plates
Index

Botany

- 12 No. 116 Report of the State Botanist for the fiscal year ending
September 30, 1906. 108p. 12pl.

Contents:

Introduction
Species added to the herbarium
Contributors and their contributions
Species not before reported
New extralimital species of fungi
Remarks and observations

Edible fungi

New York species of Hygrophorus
New York species of Russula
Explanation of plates
Index

Archeology

- 13 No. 108 Aboriginal Place Names of New York. By W. M. Beauchamp. 336p.

Contents:

Introductory
Difficulties in determining aboriginal names
Composition of local names
Authorities on language
Local names
Albany county
Allegany county
Broome county
Cattaraugus county
Cayuga county
Chautauqua county
Chemung county
Chenango county
Clinton county
Columbia county
Cortland county
Delaware county
Dutchess county
Erie county
Essex county
Franklin county
Fulton county
Genesee county
Greene county
Hamilton county
Herkimer county
Jefferson county
Kings county
Lewis county
Livingston county
Madison county
Monroe county
Montgomery county
New York county
Niagara county
Oncida county
Onondaga county
Ontario county

Local names (*continued*)

Orange county
Orleans county
Oswego county
Otsego county
Putnam county
Queens county with part of Nassau
Rensselaer county
Richmond county
Rockland county
St Lawrence county
Saratoga county
Schenectady county
Schoharie county
Schuyler county
Seneca county
Steuben county
Suffolk county
Sullivan county
Tioga county
Tompkins county
Ulster county
Warren county
Washington county
Wayne county
Westchester county
Wyoming county
Yates county
General names
New York
Pennsylvania
New Jersey
Canada
Miscellaneous
Additional names
List of authorities
Index

- 14 No. 113 Civil, Religious and Mourning Councils and Ceremonies of Adoption. By W. M. Beauchamp. 118p. 7pl.

Contents:

General nature of councils
Character and power of chiefs
Wampum in councils
The condoling council
Iroquois ceremonial manuscripts
Variations in the songs
The dead feast

Adoption
Religious councils
Nation councils
Supplementary
Authorities
Index

Geological maps

- 15 Rochester and Ontario Beach quadrangles
16 Long Lake quadrangle

IN PRESS**Memoirs**

- 17 Early Devonian of Eastern North America
- 18 Graptolites of New York. Pt 2, Graptolites of the Higher Beds

Bulletins*Geology and paleontology*

- 19 Later Glacial Waters in Central New York
- 20 Geology of the Geneva-Ovid quadrangles

Archeology

- 21 An Erie Indian Village and Burial Site

PREPARED

Maps of the following quadrangles showing rock geology

Cazenovia	Honeoye-Wayland	Phelps
Auburn	Theresa	Remsen
Morrisville		

IN PREPARATION

Maps of the following quadrangles showing rock geology

Caledonia	Moravia	Chittenango
Alexandria	Highlands	Genoa

Maps of the following quadrangles showing rock geology

Amsterdam-Broadalbin-Fonda-Gloversville
Rouse Point
Schuylerville

Paleontology

Monograph of the Devonian crinoids
Genera of the Paleozoic corals
Descriptions of Devonian plants

Entomology

Report of the State Entomologist for the fiscal year ending September 30, 1907

Botany

Annual Report of the State Botanist for the fiscal year ending September 30, 1907

IX**STAFF OF THE SCIENCE DIVISION AND STATE MUSEUM**

The members of the staff, permanent and temporary, of this division as at present constituted are:

ADMINISTRATION

John M. Clarke, *Director*
Jacob Van Deloo, *Director's clerk*

GEOLOGY AND PALEONTOLOGY

John M. Clarke, *State Geologist and Paleontologist*
David H. Newland, *Assistant State Geologist*
Rudolf Ruedemann Ph.D., *Assistant State Paleontologist*
C. A. Hartnagel B.S., *Assistant in Economic Geology*
D. Dana Luther, *Field Geologist*
Herbert P. Whitlock, C.E., *Mineralogist*
George S. Barkentin, *Draftsman*
William S. Barkentin, *Lithographer*
Joseph Morje, *First clerk*
H. C. Wardell, *Preparator*
Anna M. Byrne, *Stenographer*
C. J. Robinson, *Clerk*
Martin Sheehy, *Machinist*

Temporary assistants*Precambrian geology*

Prof. H. P. Cushing, Adelbert College
Dr C. P. Berkey, Columbia University

Stratigraphic geology

Prof. T. C. Hopkins, Syracuse University
H. O. Whitnall, Colgate University
G. H. Hudson, Plattsburg State Normal School
Prof. W. J. Miller, Hamilton College

Geographic geology

Prof. Herman L. Fairchild, Rochester University
Prof. J. B. Woodworth, Harvard University
Prof. A. P. Brigham, Colgate University

Paleontology

Dr C. R. Eastman, Harvard University
David White, United States Geological Survey
Dr T. Wayland Vaughan, United States Geological Survey
Edwin Kirk, Columbia University

BOTANY

Charles H. Peck M.A., *State Botanist*
Stewart H. Burnham, *Assistant*, Glens Falls

ENTOMOLOGY

Ephriam P. Felt B.S. D.Sc., *State Entomologist*
D. B. Young, *Assistant State Entomologist*
I. L. Nixon, *Assistant*
Anna M. Tolhurst, *Stenographer*
J. Shafer Bartlett, *Page*

Temporary assistants

Dr James G. Needham, Lake Forest College
Cornelius Betten, Lake Forest College
John R. Gillett, Albany

ZOOLOGY

George H. Chadwick, *Zoologist*
George L. Richards, *Taxidermist*

Temporary assistants

E. Howard Eaton, Canandaigua
Dr E. J. Letson, Buffalo

ARCHEOLOGY

Arthur C. Parker, *Archeologist*

Maintenance. The provision made by the Legislature of 1907 for the maintenance of the scientific work in all its branches and for the payment of all permanent and temporary services was \$46,840.

X

ACCESSIONS

ECONOMIC GEOLOGY

Donation

Picton Island Red Granite Co. New York. Cubes (12") of red and pink granite, polished, from quarries on Picton Island, near Clayton	2
Ross, James. McCormick, S. C. Specimens of manganese ores from McCormick, S. C.	27
Warren, Prof. C. H. Boston, Mass. Specimens of titaniferous magnetite from Cumberland, R. I.	8

Collection

Assistant State Geologist. Iron ores and associated rocks, Minerva, Essex county	3
Iron ores and rocks, Port Leyden, Lewis county	6
Assistant in Economic Geology. Clinton hematite, Furnaceville Iron Ore Co., Ontario	6
Clinton hematite, Fair Haven Iron Co., Sterling Station	5
Specimens of shale showing fauna from layers directly above the Clinton ore at Sterling Station	50
Clinton hematite, specimens from iron bed directly above the Pentamerus limestone, Second creek, Sodus	5
Clinton hematite, from Mareness Cagwin farm, Verona	10
Clinton hematite, from Timothy Smith's farm, Verona	2
Clinton hematite, from James Wilson farm, (Klein ore bed) Verona	3
Clinton hematite (fossil ore from upper bed) E. W. Claus farm, Verona	10
Total	137

PALEONTOLOGY

Donation

Gillard, John. Stafford. Fossils from Stafford limestone, Stafford	250
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Purchase

Breger, C. L. Ithaca. Fossil sponges from the Ithaca beds, Cornell Heights, Ithaca	40
Grebel, Wendler & Co. Geneva, Switzerland. <i>Eurypterus fischeri</i>	4
Series of graptolites	97
Krantz, Dr F. Bonn, Germany. Crustacea from various horizons and localities in Europe	98
Ward's Natural Science Establishment. Rochester. Trilobites from various formations in Europe	5
<i>Olenellus thompsoni</i> Hall. Lower Cambrian, Swanton, Vt.	4
Trilobites from various formations and localities in the United States and Europe	12

Collection

Assistant State Paleontologist. Lower Silurian and Silurian fossils from Lake Champlain, Black River and Mohawk regions	250
— & Cushing, Prof. H. P. Lower Silurian fossils from Theresa quadrangle	200
Fossils, mostly from the Pamela limestone in Jefferson county	45

Cushing, Prof. H. P. Lingula from the Potsdam (Beekmantown passage zone) of the Theresa quadrangle.....	24
Luther, D. D. Gomphoceras from concretion in Cashaqua shale.....	1
Wardell, H. C. Crustaceans from shaly layers in Shawangunk grit, Erie Railroad quarry, Otisville, Orange county.....	400
Fossils from Erie Railroad cut, western side of Pine hill near Highland Mills, Orange county	200
Fossils from the Onondaga and Stafford limestones near Leroy and Stafford, Genesee county.....	150
Total	1780

MINERALOGY

Donation

Carpenter, F. Silver and niccolite, Cobalt, Quebec, Can.....	1
Calcite (stalactitic), Camillus valley.....	1
Smith, J. A. Bisbee, Ariz. Gypsum, New Mexico.....	2
Dutcher, Louis, O. Albany. Pyrite, Colorado.....	6
Gilmore, Chas. M. Albany. Hypersthene, pyrites.....	1
Cameron, Thomas. Hermon. Calcite, Caledonia mine.....	1
Ross, J. McCormick, S. C. Psilomelane and barite, McCormick S. C....	3
Hindshaw, H. H. New York. Cyanite, Chester, Mass.....	1
Calcite, Smith's Basin.....	1
Quartz, Lyon Mountain.....	314
Quartz and asbestos ".....	4
Quartz and hematite ".....	3
Amphibole (hornblende) ".....	24
Amphibole (hornblende) and asbestos ".....	3
Hornblende, asbestos and calcite ".....	1
Hornblende and orthoclase ".....	1
Amphibole (asbestos) ".....	1
Calcite ".....	49
Apatite ".....	19
Apatite in orthoclase ".....	4
Magnetite ".....	5
Magnetite in amphibole ".....	3
Microcline ".....	8
Microcline and quartz ".....	1
Pyroxene ".....	2
Pyroxene in microcline ".....	1
Titanite ".....	1
Epidote and stilbite ".....	1
Epidote in microcline ".....	1
Pruyn, Mrs J. V. L. Albany. Pyrite, Elba, Italy.....	7
Quartz ".....	6
Hematite ".....	26
Amphibole (asbestos), Corsica.....	2
Celestite and biotite in lava, Monte Somma, Italy.....	1
Epidote, Croce di Monde, Italy.....	1
Wollastonite and amphibole, Vesuvius crater, Italy.....	2
Vesuvianite and muscovite, Bosco Reale, Italy.....	1
Gypsum, Remita, Italy.....	1
Pyroxene in lava, Torre del Greco, Italy.....	1
Chrysolite in lava, vicinity of Vesuvius, Italy.....	1
Quartz, orthoclase and biotite, Sorrento, Italy.....	1
Chrysolite, Capo di Sebastiano, Italy.....	1
Volcanic rock, vicinity of Vesuvius, Italy.....	1
Limestone, vicinity of Vesuvius, Italy.....	1
Muscovite, Capo di Quaglia, Italy.....	1

Garnet, vesuvianite and anorthite, Capo di Quaglia, Italy	1
Biotite and chrysolite, vicinity of Vesuvius, Italy	1
Garnet and vesuvianite, Vesuvius, Italy	1
Gypsum, Monte Somma, Italy	1
Epidote, Torre del Greco, Italy	1
Chrysolite and quartz, Capo di Monte, Italy	1
Galena in limestone, Vesuvius, Italy	1
Hematite (specular), Monte Somma, Italy	2
Vesuvianite, garnet and anorthite, vicinity of Vesuvius, Italy	1
Vesuvianite and garnet, Vesuvius, Italy	2
Chrysolite in lava, St Giorgio a Cremano, Italy	1
Vesuvianite and calcite, Vesuvius, Italy	1
Calcite, Vesuvius, Italy	1
Vesuvianite and epidote, Vesuvius, Italy	1
Meionite, Vesuvius, Italy	1
Muscovite and hematite, Vesuvius, Italy	1
Epidote and garnet, Vesuvius, Italy	1
Leucite in lava, Monte Somma, Italy	1
Wollastonite and amphibole, Vesuvius, Italy	2
Vesuvianite, Vesuvius, Italy	1
Wollastonite and muscovite, Vesuvius, Italy	1
Nephelite, Sebastiano, Italy	1
Stilbite, Vesuvius, Italy	1
Calcite (calcareous tufa), Vesuvius, Italy	1
Leucite in lava, Monte Somma, Italy	1
Leucite in lava, Capo di Sebastiano	1
Amphibole in lava, Vesuvius, Italy	1
Garnet and muscovite, Vesuvius, Italy	1
Chrysolite and biotite, Vesuvius, Italy	1
Leucite in lava, Torre del Greco, Italy	1
Vesuvianite, Vesuvius, Italy	2
Amphibole (hornblende), Vesuvius, Italy	1
Vesuvianite, Vesuvius, Italy	1
Anorthite, Vesuvius, Italy	1
Chrysolite and pyroxene, Sebastiano, Italy	1
Biotite and feldspar, Capo di Monte, Italy	1
Garnet and muscovite, Vesuvius, Italy	1
Chrysolite and muscovite, Vesuvius, Italy	1
Sulphur, Vesuvius, Italy	2
Sulphur in lava, Vesuvius, Italy	2
Leucite (crystals), Capo di Sebastiano	10
Sal ammoniac on lava, Vesuvius, Italy	1
Vesuvianite and muscovite, Vesuvius, Italy	1
Nephelite and amphibole, Vesuvius, Italy	1
Amphibole (tremolite), vicinity of Mont Blanc, Switzerland	1
Dolomite and pyrite " " "	1
Rhodochrosite " " "	1
Amphibole (bissolite) " " "	1
Epidote " " "	1
Galena and sphalerite " " "	1
Garnet " " "	2
Axinite " " "	1
Tourmalin " " "	1
Pyrite " " "	5
Fluorite " " "	1
Quartz " " "	2
Quartz (smoky) " " "	1
Serpentine " " "	1
Epidote " " "	1
Siderite " " "	1
Galena " " "	1
Realgar " " "	1
Calcite " " "	2

Malachite, vicinity of Mont Blanc, Switzerland.....	1
Staurolite and cyanite " "	1
Lapis Lazuli " "	1
Amphibole " "	1
Aragonite " "	1
Chalcopyrite " "	2
Molybdenite " "	1
Siderite " "	1
Azurite, Chessy, France	1

Purchase

Hodge, Capt. R. S. Antwerp. Millerite, Antwerp.....	18
Hematite, Antwerp	20
Ankerite "	19
Chalcodite "	25
Quartz "	8
Dolomite "	3
Goethite "	5
Calcite "	10
Newbury, J. O. Ripley. Garnet in gneiss, Ripley.....	1
Comptoir Min. et. Geol. Suiss. Geneva. Danburite, Piz Casanel, Spain	1
Krantz, F. Bonn, Germany. Calcite, Egremont, England.....	2
Barite and dolomite, Egremont, England.....	1
Calcite, Ith, Brunswick, Germany	1
Annabergite, Laurium, Greece	1
Apatite adularia and quartz, Rhone glacier, Switzerland.....	2
Aximite, Obira, Province of Bango, Japan.....	1
Hessite and gold, Botes, Transylvania.....	1
Opal (precious) pseu. after glauberite, White Cliffs, South Australia.	1
Beryl (aqua marine) Minas Geraes, Brazil.....	1
Liroconite, Wheal Garland, Cornwall.....	1
Wagnerite, Werfen Salzburg, Austria.....	1
Boracite, Hohenfels, Hanover, Germany.....	2
Halite with liquid inclusions, Hildesia, Hildesheim, Germany.....	1

Collection

Members of the Museum staff. Calcite, Sterlingbush.....	1000 ¹
Assistant State Geologist. Amphibole (tremolite), Gouverneur.....	4
Assistant in Economic Geology. Calcite in limestone, Accord.....	1
Mineralogist. Zircon in orthoclase and quartz, Crown Point.....	49
Biotite in orthoclase and quartz "	8
Mica (altered) "	1
Quartz "	8
Pyroxene (large), Lead hill mine, Ticonderoga.....	2
Pyroxene and graphite " "	7
Wernerite " "	1
Zircon in microcline, Spar bed "	5
Muscovite in microcline " "	1
Tourmalin (large), Buck Mt pond, Ticonderoga.....	2
Tourmalin " "	8

¹This number is estimated. The material is contained in packages (barrels and crates) and weighs 12 tons.

Amphibole (tremolite) Buck Mt pond, Ticonderoga.....	3
Serpentine in calcite " "	1
Amphibole altering to serpentine, Buck Mt pond, Ticonderoga.....	1
Calcite, Alsen	19
Calcite (large), Smith's Basin.....	1
Calcite " "	10
Calcite, Fort Miller	5
Quartz, Crystal rock, Lansingburg	33
Quartz, Glenmont.....	7
Amphibole (tremolite), Gouverneur.....	51
Amphibole " loose crystals, Gouverneur	30
Amphibole (actinolite), Gouverneur	5
Cushing, H. P. Cleveland, O. Corundum (crystals), Craigmont, Ontario, Can.....	4
Corundum in syenite, Craigmont, Ontario, Can.....	1
Wernerite in syenite " " "	1
Wernerite " " "	2
Nephelite altering to sodalite, Bancroft "	2
Total	2041

ENTOMOLOGY

Donation

Hymenoptera

- Hilton, Miss Hazel C.** Old Chatham. *Sphex ichneumonea* Linn., adult, Aug. 20
- Brown, L. F.** Cobleskill. *Pelecinus polyturator* Dru., adult, Sept. 5
- Mitchell, Miss E. G.** Washington, D. C. *Andricus seminator* Harr., wool sower, gall on oak, June 10; *A. ?petiolicola* Bass., oak leaf stalk gall, June 23, from East Orange, N. J.
- Burnham, S. H.** Albany. *Andricus singularis* Bass., oak leaf apple gall on oak, June 17; *Rhodites bicolor* Harr., spiny bullet gall on rose, June 17, from Shushan, N. Y..

Coleoptera

- Bogue, Virgil.** Albion. *Xyleborus dispar* Fabr., pear blight beetle, adult on peach, June 4
- Pettis, C. R.** Lake Clear Junction, N. Y. *Lachnosterna ? fusca* Froh., May beetle, larvae attacking roots of seedling pines, Aug. 19
- Woodruff, E. S.** Wawbeck. *Lachnosterna ? fusca* Froh., May beetle, larvae on roots of evergreens, Aug. 27
- Peck, C. H.** Albany. *Plesiocis cribrum ?* Casey, adult on *Polyporus* on spruce, May 21, from Woburn, Mass.
- Pearsall, R. F.** Brooklyn. *Acoptus suturalis* Lec.; *Piazurus oculatus* Say; *Conotrachelus anaglypticus* Say; *Ipthi-*

mus opacus Lec.; *Oncideres cingulata* Say; *Dorcus parallelus* Say; *Corymbites hamatus* Say; *Geopinus incrassatus* Dej.; *Dicaelus dilatatus* Say; *Notiophilus sibiricus* Mots.; *Calosoma externum* Say; *Carabus serratus* Say, Jan. 21

Alexander, Charles P. Gloversville, has contributed a number of species, some extremely desirable, in return for numerous identifications.

Diptera

Alcott, D. W. East Greenbush. *Olfersia americana* Leach, adult on barred owl, Oct. 25

Clarke, Miss C. H. Boston, Mass. *Agromyza (?) aeneiventris* Fall., larvae, Nov. 11

Cockerell, T. D. A. Boulder, Col. *Trypeta bigeloviae* Ckll., galls, June 24, from Florissant, Col.

Joutel, L. H. New York. A number of *Cecidomyiid* galls

Thompson, Dr M. T., lately deceased, formerly of Clark University, Worcester, Mass. A number of *Cecidomyiidae*, mostly bred species

Clarke, Miss Cora H. Boston, Mass. *Cecidomyiid* galls taken mostly in the vicinity of Magnolia, Mass., a few near Boston

Bryant, Owen. Cohasset, Mass. Numerous *Cecidomyiidae*

Mitchell, Miss Evelyn G. Washington, D. C. *Cecidomyiid* galls, mostly from the vicinity of Washington

Tucker, E. S. Plano, Texas. *Cecidomyiidae* from Kansas and Texas

Cockerell, Prof. T. D. A. Boulder, Col. *Cecidomyiid* galls and adults

Fletcher, Dr James. Central Experimental Farms, Ottawa, Can. Several *Cecidomyiid* galls

Jarvis, Prof. T. D. Ontario Agricultural College, Guelph, Ont. Numerous *Cecidomyiid* galls

Willing, T. N. Regina, Sask, N. W. T. A number of *Cecidomyiid* galls

Criddle, Norman. Treesbank, Manitoba, Can. A number of *Cecidomyiid* galls and bred adults

Howell, J. Highland Falls. *Cecidomyia verrucicola* O. S., linden leaf galls on linden or basswood, Nov. 14

Fisher, W. S. High Spire, Pa. *Asphondylia conspicua* O. S., galls and larvae on *Rudbeckia laciniata*, Aug. 18

Forbes, Prof. S. A. Urbana, Ill. *Neocerata rhodophaga* Coq., adult and larvae, Dec. 8

Stowell, E. Channing. Dublin, N. H. *Taeniorhynchus perturbans* Walk., adults, July 30; *Eucorethra underwoodi* Undw., larvae, Aug. 28

Marshall, D. T. Hollis, L. I. *Culex pipiens* Linn., house mosquito, adults, Sept. 23; *Culicada sollicitans* Walk., salt marsh mosquito, adults, Aug. 3

Pearsall, R. F. Brooklyn. Tipulidae, several species; *Pediscia albivitta* Walk.; *Xylota vecors* O. S., Jan. 21

Lepidoptera

Hill collection

This is an exceptionally valuable addition to the State collections, consisting of some 10,000 specimens, representing approximately 3500 species. It is in excellent condition and was donated by Erastus D. Hill, Carrie J. Hill Van Vleck and William W. Hill, heirs of the late William W. Hill of Albany. The catalogue of this collection is given in the Entomologist's report.

- Booth, A. J.** Manila, P. I. *Attacus atlas* Linn., adult, Sept. 17
Greene, F. J. Centre Berlin. *Anisota rubicunda* Fabr., green striped maple worm, on maple, Aug. 12; *Heterocampa guttivitta* Walk., on maple, Aug. 12
Hill, Mrs Alex. Hiland. Palenville. *Epizeuxis denticulalis* Harv., adult, July 31
Stearns, W. A. Centre Berlin. *Heterocampa guttivitta* Walk., larvae, on maple, Aug. 22
Chew, J. M. Newburgh. *Ennomos subsignarius* Hubn., snow-white linden moth, adults, Sep. 9
Bailey, Dr T. P. Albany. *Leucobrephe brepheoides* Walk., adult, April, from St Lawrence county
Lackay, W. E. Rensselaer. *Phobetron pithecium* Abb. & Sm., hag moth caterpillar, larvae on maple, Sept. 17.
Huested, S. B. Blauvelt. *Zeuzera pyrina* Fabr., leopard moth, on apple, Oct. 30
Alexander, C. P. Gloversville. *Eucosma scudderiana* Clem., larvae on solidago, Feb. 27
Eldridge, C. E. Leon. *Ancylus nubeculana* Clem., apple leaf folder, larvae on apple, Sept. 17
Knox, Miss A. A. New York city. *Mompha brevivittella* Clem. and *M. eloisella* Clem., adults on *Oenothera grandiflora*, Oct. 16
Pearsall, R. F. Brooklyn. *Philopsia nivigerata* Walk.; *Euchoeca exhumata* Pears cotype; *Mesolueuca immanata* Haw.; *Petrophora fluctuata* Linn.; *Orthofidonia exornata* Walk.; *Sicya macularia* Harr.; *Therina endropiaria* Walk.; *Plagodis serinaria* H-S; *P. phlogosaria* Guen., Jan. 21, from Indian Valley, Catskill Mts

Hemiptera

- Barger, Mrs Milton.** St Lawrence county. *Phylloxera caryae-caulis* Fitch, hickory gall aphid, galls on hickory, May 27
Hagen, C. W. Sparrowbush. *Empoasca mali* LeB., apple leaf hopper, adult on apple, July 1
Kidder, G. S. Port Henry. *Myzus cerasi* Fabr., cherry aphid, adults on cherry, July 12
Guyett, F. E. Rensselaer. *Nectarophora pisi* Kalt., pea aphid, adults on peas, July 13
Howe, C. D. Pisgah Forest, N. C. *Chermes pinicorticis* Fitch, pine bark aphid on pine, Apr. 30

- Cockerell, Prof. T. D. A.** Boulder, Col. *Phoenacoccus marlatti* Ckll., on date palm, Mar. 30, from Tempe, Arizona
- Fletcher, Dr James.** Central Experimental Farms, Ottawa, Can. *Aspidiotus forbesi* John., cherry scale, adults on basswood, Apr. 25
- Wohlers, R.** Williamsville. *Aspidiotus ostreaeformis* Curtis, European fruit scale, adults and young on plum, May 8
- Courtney, N. J.** Cornwall-on-Hudson. *Aspidiotus perniciosus* Comst., San José scale on apple, Apr. 15
- Stone, D. D.** Oswego. *Aspidiotus perniciosus* Comst., San José scale, adults on currant, May 30
- Peck, C. H.** Albany. *Aulacaspis rosae* Bouché, rose scale, adults and larvae on raspberry, Mar. 29
- Hicks, Isaac & Son.** Westbury Station. *Chionaspis pinifoliae* Fitch, pine leaf scale, eggs on pine, Nov. 9
- Merritt, Mrs Douglas.** Rhinebeck. *Gossyparia spuria* Mod., elm bark louse, females on elm, June 15

Orthoptera

- Fairman, C. E.** Lyndonville. *Nyctobora holosericia* Klug., giant cockroach, adult, July 1, from Albany

Mallophaga

- Alcott, D. W.** East Greenbush. *Docophorus syrnii*? Pack. adult on barred owl Oct. 25
- Chadwick, G. H.** *Docophorus syrnii*? Pack. on barred owl, Nov. 13; *Haematopinus antennatus*? Osb. on gray squirrel, Nov. 8; *Lipeurus baculus* Nitzsch on pigeon, Nov. 4; *Lipeurus* sp. on Gadwall duck, Nov. 4; *Goniocotes compar* Nitzsch on pigeon, Nov. 4; *Trinoton luridum* Nitzsch on Gadwall, Oct. 30; same, on duck, Nov. 8; same Burrow Golden eye

Corrodentia

- Voelckel, Emil.** Wakefield, New York city. *Atropos divinatoria* Fabr., book louse, adult, Oct. 30
- Mairs, Mrs Edwin H.** Irvington-on-Hudson. *Psocus venosus* Burm., adult on decayed vegetable matter, Aug. 24, from Washington, Conn.

Exchange

Diptera

- Johnson, Prof. C. W.** Boston, Mass. *Neaspilota achilleae* Johns., *N. albidipennis* Loew., *N. vernoniae* Loew., *Trypeta palposa* Loew., *Stenomylia tenuis* Loew., *Chaetopsis apicalis* Johns., *Tetanops luridipennis* Loew., *Melieria obscuricornis* Loew., *Rivellia brevifasciata* Johns., *R. quadrifasciata* Macq., *Thelaira leucozona* Panz., *Paraprosena apicalis* Desv., *Echinomyia florum* Walk., *Opsidia gonioides* Coq., *Chae-*

- toplagia atripennis Coq., Sturmia nigrita Town., Epigrymyia polita Town., Actia pilipennis Fall., Trichopoda plumipes Fabr., Alophora aeneoventris Will., Hydrophorus eldoradensis Wheeler, H. viridiflos Walk., Neurigona lateralis Say, Agonosoma unifasciatum Say (bicolor Loew.), Psilopodinus comatus Loew., Mallophora orcina Wied., Erax maculatus Macq. (lateralis Macq.), Laphria canis Will., L. sericea Say, Atomosia puella Wied., A. sayii Johns., Cerotainia macrocera Say, Nicocles pictus Loew., Dero-myia platyptera Loew., Stichopogon argenteus Say, Holopogon guttula Wied., Holcocephala calva Loew., Lasiopogon terricola Johns., Cyrtopogon lutatius Walk., Psilocurus nudiusculus Loew., Laphystia sexfasciata Say, Leptogaster annulatus Say, L. pictipes Loew., Geron calvus Loew., G. sigma Coq., Systoechus solitus Walk., Anthrax ceyx Loew., A. edititia Say, A. lucifer Fabr., Exoprosopa eremita O. S., Tabanus fuscopunctatus Macq., T. recedens Walk., T. sparus Whitney, Chrysops nigrilimbo Whitney.
- Melander, Prof. A. L.** Pullman, Wash. Caenia spinosa Loew., Parydra quadrituberculata Loew., P. limpidi-pennis Loew., Hydrellia hypoleuca Loew., Paralimna appendiculata Loew., Tephritis variabilis Doane, T. finalis Loew., Ensina humilis Loew., Spilographa diffusa Snow, Sepedon armipes Loew., Tetanocera plumosa Loew., T. pallida Loew., Sciomyza pubera Loew., S. nana Fall., S. humilis Loew., Criorhina scitula Will., Xylota flavitibia Bigot, Eristalis temporalis Thom., E. occidentalis Will., E. bastardii Macq., Volucella esuriens Fabr., Mesogramma boscii Macq., Syrphus diversipes Macq., Platychirus chaetopodus Will., Chrysogaster stigmata Will., C. lata Loew., Chryso-toxum derivatum Walk.

Orthoptera

- Britton, Dr W. E.** New Haven, Conn. Spharagemon bolii Scud., S. saxatile Morse, Psinidia fenestralis Serv., Scirtetica marmorata Harr., Paroxya floridana Thom., Orphulella speciosa Scud., O. pelidna Burm.

ZOOLOGY

Donation

Mammals

- Alexander, C. P.** Gloversville. Say's bat, Myotis subulatus (Say)..... 1
- Paine, J. A.** Tarrytown. Deer mouse, Peromyscus leucopus noveboracensis (Fischer)..... 1
- Wales, Mrs L. J.** Kenosha Lake. Little brown bat, Myotis lucifugus (Le Conte)..... 2

Birds

Alexander, C. P. Gloversville. Winter wren, <i>Anorthura hiemalis</i> (Vieill.)	1
Saw-whet owl, <i>Nyctala acadica</i> (Gmel.).....	1
Ashbury, L. O. Auburn. American hawk owl, <i>Surnia ulula caparoch</i> (Müll.)	1
Northern pileated woodpecker, <i>Ceophloeus pileatus abieticola</i> Bangs	1
Badger, Geo. B. Amityville. Turnstone, <i>Arenaria interpres</i> (Linn.)	1
Richard, Will. Cody, Wyoming. Northern phalarope, <i>Phalaropus lobatus</i> (Linn.).....	3
Wilson's phalarope, <i>Steganopus tricolor</i> (Vieill.).....	1
American avocet, <i>Recurvirostra americana</i> (Gmel.).....	1
Western willet, <i>Symphemia semipalmata inornata</i> Brewst.	1
Townsend's solitaire, <i>Myadestes townsendii</i> (Aud.)..	1
Rothaupt, Geo. Jerusalem, Albany co. English sparrow, passer domesticus (Linn.), albinistic specimen.....	1
Thayer, Gerald. Monadnock, N. H. European linnet, <i>Acanthis cannabina</i> (Linn.), taken at Scarboro, N. Y., in 1894; first N. Y. State record.....	1
Vroman, Wilson N. State Department of Agriculture. American goshawk, <i>Accipiter atricapillus</i> (Wils.).....	1
Ward's Nat. Sci. Estab. Rochester. Ring-necked pheasant, <i>Phasianus torquatus</i> (Gmel.).....	1
Whaley, Robert. Sterlingbush. Red-shouldered hawk, <i>Buteo lineatus</i> (Gmel.)	1

Reptiles and batrachians

Alexander, C. P. Gloversville. Ring-necked snake, <i>Diadophis punctatus</i> (Linn.).....	1
Brown snake, <i>Storeria occipitomaculata</i> (Storer)....	1
Red-backed salamander, <i>Plethodon cinereus erythronotus</i> (De Kay).....	3
Striped-backed salamander, <i>Spelerpes bilineatus</i> (Green)..	2
Dusky salamander, <i>Desmognathus fuscus</i> (Raf.).....	3
Wood frog, <i>Rana sylvatica</i> (Le Conte).....	1
Cook, John. Albany. Ring-necked snake, <i>Diadophis punctatus</i> (Linn.)	1
Young, D. B. Albany. Blue-spotted salamander, <i>Plethodon glutinosus</i> (Green)?.....	1

Fish

Higgins, T. F. Schenectady. Common gurnard, <i>Prionotus carolinus</i> (Linn.).....	1
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Arachnida

Alexander, C. P. Gloversville and Johnstown. Numerous sendings of spiders and mites, including many forms new to the collection, and some undescribed species. Not yet fully listed.	
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Beach, Mrs Chas. Catskill Mountain House. Spider, <i>Epeira displicata</i> (Hentz), yellow var.....	1
Chadwick, Miss Nathalie. Catskill. Spider, <i>Steatoda borealis</i> (Hentz)	1
Congdon, Miss L. C. Catskill. Grass spider, <i>Agelena naevia</i> (Walck)	1
Spider. <i>Pardosa</i> sp.	1
Cook, John. Albany. Crab spider, <i>Xysticus</i> sp.....	1
Dobbin, Frank. Shushan. Galls of <i>Eriophyes</i> on alder leaves.....	3
Duncan, George T. Rochester. <i>Heteropoda venatoria</i> (Linn.) and other spiders.....	7
Fletcher, Dr James. Ottawa, Canada. Gall of <i>Eriophyes</i> on <i>Spiraea salicifolia</i> , and spiders.....	5
Foster, Miss Marion. New Paltz. Galls of <i>Eriophyes acericola</i> (Garman).....	2
Hall, C. K. East Schodack. Spider, <i>Epeirastrix</i> (Hentz).....	1
Joutel, L. H. New York city. Galls of <i>Eriophyes</i> on ash and poplar..	2
Little, Miss E. W. C. Menands. Triangle spider, <i>Hyptiotes cavatus</i> (Hentz)	1
Mirguet, John, and Laird, James. Rochester. Spiders and phalangids, not fully listed.....	17
Mitchell, Miss. East Orange, N. J. Galls of <i>Eriophyes acericola</i> (Garman)	3
Weeks, A. H. Jamaica, L. I. Two sendings of spiders, not fully listed.	15
Wilke, A. F. T. Paterson. Golden-rod spider. <i>Misumena aleatoria</i> (Hentz).....	1

Myriapoda and crustacea

Alexander, C. P. Gloversville. Several sendings not yet classified.
Chadwick, Mrs C. S. Catskill. Shrimps, *Asellus communis*

Mollusca

Alexander, C. P. Gloversville. <i>Zonitoides arboreus</i> (Say) ..	1
<i>Polygyra albolabris</i> (Say).....	1
<i>Polygyra palliata</i> (Say).....	1
<i>Philomycus carolinensis</i> (Bosc.).....	1
<i>Agriolimax campestris</i> (Binney).....	2
<i>Succinea ovalis</i> Say (obliqua).....	2
<i>Succinea ovalis totteniana</i> Lea.....	1
<i>Limnaea desidiosa</i> Say.....	1
<i>Physa niagarensis</i> (?) Lea.....	5
<i>Aplexa hypnorum</i> (Linn.).....	1
<i>Planorbis bicarinatus</i> Say.....	2
Letson, Dr E. J. Buffalo Society of Natural Science. <i>Polygyra tridentata</i> (Say)	2
<i>Polygyra albolabris</i> (Say)	2
<i>Polygyra thyroides</i> (Say).....	2
<i>Polygyra palliata</i> (Say).....	2
<i>Polygyra exoleta</i> (Say).....	2

<i>Lampsilis ventricosus</i> (Barnes).....	1
<i>Lampsilis luteolus</i> (Lamk.).....	2
<i>Lampsilis ligamentinus</i> (Lamk.).....	1
<i>Lampsilis alatus</i> (Say).....	2
<i>Lampsilis gracilis</i> (Barnes).....	1
<i>Obovaria ellipsis</i> (Lea).....	1
<i>Strophitus edentulus</i> (Say)	1
<i>Symphynota compressa</i> (Lea).....	1
<i>Symphynota costata</i> (Raf.).....	1
<i>Alasmidonta calceolus</i> (Lea).....	2
<i>Unio gibbosus</i> Barnes.....	2
<i>Quadrula undulata</i> (Barnes).....	1

Purchase

Birds

Ashbury, L. O. Auburn. Gyrfalcon, <i>Falco rusticolus gyrfalco</i> (Linn.).....	1
Coale, H. K. Chicago. Black rail, <i>Porzana jamaicensis</i> (Gmel.)... ..	2
Eaton, E. H. Rochester. Blue geese, <i>Chen caerulescens</i> (Linn.)... ..	2
American egret, <i>Ardea egretta</i> (Gmel.).....	1
Langille, Rev J. H. Kensington, Md. Yellow-billed tropic bird, <i>Phaethon americanus</i> (Grant) taken at Knowlesville, N. Y.; first N. Y. State record.....	1
Parker, Foster. Cayuga. Black-bellied plover, <i>Squatarola squatarola</i> (Linn.)	1
Turnstone, <i>Arenaria interpres</i> (Linn.).....	1
Rose-breasted grosbeak, <i>Zamelodia ludoviciana</i> (Linn.)..	1
Van Valkenburgh, Edward. West Ghent. (per H. J. Richardson) Red-shouldered hawk, <i>Buteo lineatus</i> (Gmel.), albino.....	1
Ward's Natural Science Establishment. Rochester. Ivory gull. <i>Pagophila alba</i> (Gunn.)	1
Little gull, <i>Larus mintus</i> (Pall.).....	1
Yellow-billed tropic bird, <i>Phaethon americanus</i> (Grant)...	1
Pintail, <i>Dafila acuta</i> (Linn.).....	1
Rufous-crested duck, <i>Netta rufina</i> (Pall.).....	1
White-winged scoter, <i>Oidemia deglandi</i> (Bonap.).....	1
White-bellied brant, <i>Branta bernicla glaucogastra</i> (Brehm).....	1
Red phalarope, <i>Crymophilus fulicarius</i> (Linn.).....	1
Red-backed sandpiper, <i>Tringa alpina pacifica</i> (Coues)..	1
Passenger pigeon, <i>Ectopistes migratorius</i> (Linn.)....	1
Red headed woodpecker, <i>Melanerpes erythrocephalus</i> (Linn.)	1
Webster Co., F. B. Hyde Park, Mass. Whooping crane, <i>Grus americana</i> (Linn.).....	1
Gray kingbird, <i>Tyrannus dominicensis</i> (Gmel.).....	1
Chestnut-collared longspur, <i>Calcarius ornatus</i> (Townsend)	1

Worthen, C. K. Warsaw, Ill. Pied-billed grebe, <i>Podilymbus podiceps</i> (Linn.)	2
Parasitic jaeger, <i>Stercorarius parasiticus</i> (Linn.)..	1
Sabine's gull, <i>Xema sabinii</i> (Sab.).....	1
Royal tern, <i>Sterna maxima</i> (Bodd.).....	1
Arctic tern, <i>Sterna paradisaea</i> (Brünn).....	1
Black tern, <i>Hydrochelidon nigra surinamensis</i> (Gmel.)	1
Fulmar, <i>Fulmarus glacialis</i> (Linn.).....	1
Sooty shearwater, <i>Puffinus fuliginosus</i> (Strickland).....	1
Scaled petrel, <i>Aestrelata scalaris</i> (Brewst.).....	1
Brown pelican, <i>Pelecanus fuscus</i> (Linn.).....	1
Man-o'-war bird, <i>Fregata aquila</i> (Linn.).....	1
Red-breasted merganser, <i>Merganser serrator</i> (Linn.)..	1
European widgeon, <i>Mareca penelope</i> (Linn.).....	2
Cinnamon teal, <i>Querquedula cyanoptera</i> (Vieill.)....	1
Harlequin duck, <i>Histrionicus histrionicus</i> (Linn.)....	1
Brant, <i>Branta bernicla</i> (Linn.).....	1
White ibis, <i>Guara alba</i> (Linn.).....	1
Glossy ibis, <i>Plegadis autumnalis</i> (Hasselq.).....	1
Snowy heron, <i>Ardea andidissima</i> Gmel.....	1
Little blue heron, <i>Ardea caerulea</i> Linn.....	2
Northern phalarope, <i>Phalaropus lobatus</i> (Linn.).....	1
Dunlin, <i>Tringa alpina</i> (Linn.).....	1
Red-backed sandpiper, <i>Tringa alpina pacifica</i> (Coues)	1
Semipalmated sandpiper, <i>Ereunetes pusillus</i> (Linn.)....	1
Western sandpiper, <i>Ereunetes occidentalis</i> (Lawr.).....	1
Sanderling, <i>Calidris arenaria</i> (Linn.).....	2
Greater yellow-legs, <i>Totanus melanoleucus</i> (Gmel.)..	1
Western willet, <i>Symphemia semipalmata inornata</i> (Brewst.)	1
Black-bellied plover, <i>Squatarola squatarola</i> (Linn.)..	1
Semipalmated plover, <i>Aegialitis semipalmata</i> (Bonap)..	1
Willow ptarmigan, <i>Lagopus lagopus</i> (Linn.).....	1
Swallow-tailed kite, <i>Elanoides forficatus</i> (Linn.)....	1
Sharp-shinned hawk, <i>Accipiter velox</i> (Wils.).....	1
Sainson's hawk, <i>Buteo swainsoni</i> (Bonap.).....	2
Northern hairy woodpecker, <i>Dryobates villosus leucomelas</i> (Bodd.).....	1
Alder flycatcher, <i>Empidonax traillii alnorum</i> Brewst.	1
Starling, <i>Sturnus vulgaris</i> Linn.....	1
Bullock's oriole, <i>Icterus bullocki</i> (Swains.).....	1
European goldfinch, <i>Carduelis carduelis</i> (Linn.).....	1
Sharp-tailed sparrow, <i>Ammodramus caudacutus</i> (Gmel.)	2
Nelson's sparrow, <i>Ammodramus nelsoni</i> (Allen).....	2
Painted bunting, <i>Cyanospiza ciris</i> (Linn.).....	1
Orange-crowned warbler, <i>Helminthophila celata</i> (Say)	2
Northern parula warbler, <i>Compsothlypis americana usneae</i> (Brewst.).....	1
Cape May warbler, <i>Dendroica tigrina</i> (Gmel.).....	1

Batrachia

- Ward's Natural Science Establishment. Rochester. Hellbender,
Cryptobranchus allegheniensis Daudin..... 1

Fish

- Duncan, George T. Rochester. Wall-eyed pike, *Stizostedion*
vitreum (Mitch.) 1

Exchange

- Tucker, E. S. Lawrence, Kan. Spiders..... 16

Collection*Mammals*

- Red squirrel, *Sciurus hudsonicus loquax* (Bangs)..... 2
 White-footed mouse, *Peromyscus leucopus novebor-*
acensis (Fischer) 1
 Meadow mouse, *Microtus pennsylvanicus* (Ord.)..... 1
 Muskrat, *Fiber zibethicus* (Linn.) (with material for mounted
 nest) 1
 Woodland jumping-mouse, *Napaeozapus insignis* (Miller)..... 1
 Big brown bat, *Vespertilio fuscus* (Beauvois.)..... 1

Birds

- Ring-billed gull, *Larus delawarensis* (Ord.)..... 1
 Mallard, *Anas boschas* (Linn.)..... 1
 Black duck, *Anas obscura* (Gmel.)..... 1
 Red-legged black duck, *Anas obscura rubripes*..... 1
 Gadwall, *Chaulelasmus streperus* (Linn.)..... 1
 Green-winged teal, *Nettion carolinensis* (Gmel.)..... 2
 Blue-winged teal, *Querquedula discors* (Linn.)..... 1
 Pintail, *Dafila acuta* (Linn.)..... 1
 Lesser scaup duck, *Aythya affinis* (Eyt.)..... 2
 American golden-eye, *Clangula clangula americana*
 (Faxon) 3
 Barrow's golden-eye, *Clangula islandica* (Gmel.)..... 2
 Old squaw, *Harelda hyemalis* (Linn.)..... 1
 American coot, *Fulica americana* (Gmel.)..... 1
 American woodcock, *Philohela minor* (Gmel.)..... 1
 Knot, *Tringa canutus* Linn..... 1
 Least sandpiper, *Tringa minutilla* (Vicill.)..... 1
 Semipalmated sandpiper, *Ereunetes pusillus* (Linn.)..... 1
 Sanderling, *Calidris arenaria* (Linn.)..... 1
 Solitary sandpiper, *Helodromas solitarius* (Wils.)..... 2
 Bartramian sandpiper, *Bartramia longicauda* (Bechst.)... 1
 Spotted sandpiper, *Actitis macularia* (Linn.)..... 1
 Black-bellied plover, *Squatarola squatarola* (Linn.)..... 3
 American golden plover *Charadrius dominicus* (Müll.)..... 1
 Semipalmated plover, *Aegialitis semipalmata* (Bonap.)..... 2
 Turnstone, *Arenaria interpres* (Linn.)..... 2

English pheasant, <i>Phasianus colchicus</i> (Linn.).....	1
Sharp-shinned hawk, <i>Accipiter velox</i> (Wils.).....	1
Yellow-bellied sapsucker, <i>Sphyrapicus varius</i> (Linn.)....	1
Ruby-throated hummingbird, <i>Trochilus colubris</i> (Linn.)...	1
Alder flycatcher, <i>Empidonax traillii alnorum</i> (Brewst.)....	1
Least flycatcher, <i>Empidonax minimus</i> (Baird).....	2
Meadowlark, <i>Sturnella magna</i> (Linn.).....	1
Redpoll, <i>Acanthis linaria</i> (Linn.).....	2
Greater redpoll, <i>Acanthis linaria rostrata</i> (Coues).....	1
Savanna sparrow, <i>Ammodramus sandwichensis savanna</i> (Wils.)	1
Grasshopper sparrow, <i>Ammodramus savannarum passerinus</i> (Wils.)	1
Sharp-tailed sparrow, <i>Ammodramus caudacutus</i> (Gmel.)..	2
Seaside sparrow, <i>Ammodramus maritimus</i> (Wils.).....	1
White-throated sparrow, <i>Zonotrichia albicollis</i> (Gmel.)..	3
Song sparrow, <i>Melospiza fasciata</i> (Gmel.).....	1
Towhee, <i>Pipilo erythrophthalmus</i> (Linn.).....	1
Scarlet tanager, <i>Piranga erythromelas</i> Vieill.....	1
Cedar waxwing, <i>Ampelis cedrorum</i> (Vieill.).....	2
Nashville warbler, <i>Helminthophila rubricapilla</i> (Wils.)..	1
Yellow warbler, <i>Dendroica aestiva</i> (Gmel.).....	1
Myrtle warbler, <i>Dendroica coronata</i> (Linn.).....	3
Magnolia warbler, <i>Dendroica maculosa</i> (Gmel.).....	1
Black-throated green warbler, <i>Dendroica virens</i> (Gmel.)...	1
Pine warbler, <i>Dendroica vigorsii</i> (Aud.).....	1
Yellow palm warbler, <i>Dendroica palmarum hypochrysea</i> Ridgw.	1
Water-thrush, <i>Seiurus noveboracensis</i> (Gmel.).....	1
Northern yellow-throat, <i>Geothlypis trichas brachydactyla</i> (Swain.)	2
Wilson's warbler, <i>Wilsonia pusilla</i> (Wils.).....	1
Brown thrasher, <i>Harporhynchus rufus</i> (Linn.).....	1
Winter wren, <i>Anorthura hiemalis</i> (Vieill.).....	1
Golden-crowned kinglet, <i>Regulus satrapa</i> (Licht.).....	3
Ruby-crowned kinglet, <i>Regulus calendula</i> (Linn.).....	1

Reptiles and batrachians

Wood tortoise, <i>Chelopus insculptus</i> (Le Conte).....	1
A number of salamanders not yet identified	

Invertebrates

Several hundred specimens of spiders, mites and mite-galls have been collected, with incidentally some myriapods, entomostraca and mollusca.

Total 323

ARCHEOLOGY

Donation

- Hartnagel, C. A.** Stone pipe stem from Union Springs
Cleveland, A. A. Triangular "bear's head" stone
Parker, A. C. String of condolence wampum
Edson, Obed & Reed, Richard. Parts of 5 skeletons

Purchase

Woodworth, A. R. Springboro, Pa. The following from Ithaca

- 35 arrow and spearheads
 1 pestle

- 4 celts
 1 pipe with 4 stem holes

Fitch, Luke I. Manlius

- 7 smooth perforated coins
 1 Martin Van Buren token
 1 penny of 1804
 1 copper point
 11 brass arrowheads
 1 iron gun wormer
 4 iron awls
 1 lead spiral
 3 small lead spirals
 1 thimble
 1 copper scrap
 1 part of a hinge
 2 lead seals
 2 lead rings with knobs
 14 Jesuit rings
 1 Masonic brooch
 6 "hawk" bells
 7 iron knives
 1 flint lock
 1 bullet mold
 1 gun wormer
 1 pair shears
 4 potsherds
 2 awls
 1 beaver tooth
 1 chunk of antler
 9 iron awls

- 1 pick, iron
 5 thimbles
 1 lead cylinder
 4 copper points
 2 brass jinglers
 1 phalanx bone
 2 bone fishhooks, fine specimens
 2 jew's-harp handles
 8 kaolin pipe bowls
 2 iron hooks
 7 string Indian trade beads
 1 string of shell beads
 1 wolf's tooth, perforated
 1 elk's tooth, perforated
 1 string of beads
 1 bone pipe bowl
 1 pendant
 1 disk
 1 string of beads
 1 double-pointed awl, bone
 1 knife or awl of bone
 1 fish bone awl
 3 perforated teeth
 12 bone beads
 2 wolf teeth
 19 awls, bone

Hill, Walter C. New York

- 1 old Iroquois beaded cap used in 1847
 1 set of 19 old Penobscot silver disks, Oldtown, Me.
 2 Iroquois silver crowns
 1 bark basket, Algonquin

- 1 wampum belt, called the condolence belt. Purple background and six bars of white, cross and square in the middle
 1 game, platter dice; platter and 6 dice

Harrington, M. R. New York

- 1 false face. Onondaga
 1 pack strap, Canadian type
 1 drum and 3 sticks
 1 large flute, cedar. Cayuga
 1 bone necklace. Cayuga
 1 gorget with shell string attached. Cayuga
 1 pair deer hoof knee rattles

- 1 necklace of buckskin, etc.
 1 knife sheath and knife. Cayuga
 1 pair shoe packs. Cayuga
 1 scraper for removing snow from clothing
 1 string Tuteli adoption wampum
 1 wooden bowl

ARTICLES FROM ST REGIS RESERVATION

1 woman's legging	1 carved cradle board
1 fragment of legging, beaded	1 bean or sugar bos, bark

ARTICLES FROM MUNCEYTOWN, ONT.

2 bark bowls	1 bark bag
1 coiled basket	1 bark spoon

ARTICLES FROM MORAVIANTOWN, ONT.

2 bowls	1 pair earrings
4 wooden spoons	1 knife
1 pack strap	8 baskets
1 pudding stick	1 wooden bowl
1 tomahawk fragment	1 pack frame
5 brooches, silver	1 splint cutter

Collection

20 skulls	1 bag pottery from central pit, Gerry
40 femora	1 bag pottery from ash deposits
Parts of 65 skeletons from McCul- lough farm, Gerry	1 bag stone implements
125 potsherds, in 2 boxes	2 celts
50 arrow points	10 arrow points
5 spears	1 pottery vessel
2 celts	1 pipe
1 crushed pot	1 pestle
1 small celt	1 net sinker
5 hammerstones	2 gorgets from Cassadaga
1 pipe stem	1 bag flints
1 heron's bill, from grave	1 gorget, Irving
2 pottery vessels, crushed	

Purchase and collection in the field

1 wampum string, runner's an- nouncement	1 large round brooch
1 pair baby moccasins	23 square brooches, silver
1 wampum string, condolence or "horns"	1 ceremonial overdress
1 pair women's leggings	1 earring and pendant
1 burden strap	1 silver and glass ear pendant
40 silver brooches	1 flute
2 ladles	1 Eagle dance headdress, heron feathers
1 paddle	2 deer skin gambling mats
1 Eagle dance rattle	1 buffalo skin ceremonial robe
1 Prayer rattle	1 turtle shell rattle
1 pair women's leggings	1 flute, Logan
1 woman's dress, ceremonial	1 blow pipe
20 brooch maker's tools	1 corn sieve basket

Total 722+

XI

Appendix A

NEW ENTRIES ON GENERAL RECORD OF LOCALITIES
OF AMERICAN PALEOZOIC FOSSILS BELONGING
TO STATE MUSEUM

Alphabetic list of localities

Brownsville (Jefferson co.), 3589	Perch lake (Jefferson co.), 3571, 3575
Buffalo (Erie co.), 3565	Plattsburgh (Clinton co.), 3576
Chazy (Clinton co.), 3580, 3584	Pulaski (Oswego co.), 3597
Clinton (Oneida co.), 3598, 3599	Sandy Hill (Saratoga co.), 3595
Crabb island (Clinton co.), 3586	Sanfords Corners (Jefferson co.), 3588, 3590, 3591
Delhi (Delaware co.), 3557	Saratoga Springs (Saratoga co.), 3573
East Canada creek (Fulton co.), 3587	Sloop island (Clinton co.), 3586
Eskdale, New Brunswick, Can., 3563	Smith's Landing (Greene co.), 3561
Evans Mills (Jefferson co.), 3568, 3572, 3588, 3593, 3608, 3610, 3611	Stafford (Genesee co.), 3559
Griswold (Wyoming co.), 3560	Stone Mills (Jefferson co.), 3606, 3607
Highland Mills (Orange co.), 3600, 3601, 3602	Swanton, Vt., 3562
Indian river (Jefferson co.), 3610	Theresa (Jefferson co.), 3558, 3560, 3612
Ingham Mills (Herkimer co.), 3594	Valcour island (Clinton co.), 3570, 3581, 3585
Ithaca (Tompkins co.), 3556	Valcour (Clinton co.), 3578
La Fargeville (Jefferson co.), 3601, 3605, 3609	Watertown (Jefferson co.), 3582, 3583, 3592
Lebanon, Ohio, 3567	Waterville (Oneida co.), 3366
Le Raysville (Jefferson co.), 3570, 3574, 3603	
Lorraine gorge (Jefferson co.), 3596	
Otisville (Orange co.), 3564	

New York localities according to counties

Names in italics are new to the record.

CLINTON CO.	HERKIMER CO.	ONEIDA CO.
Chazy	<i>East Canada creek</i>	Clinton
<i>Crabb island</i>	<i>Ingham Mills</i>	Waterville
Plattsburg	JEFFERSON CO.	ORANGE CO.
<i>Sloop island</i>	Brownville	<i>Highland Mills</i>
Valcour	<i>Evans Mills</i>	Otisville
Valcour island	<i>Indian river</i>	OSWEGO CO.
DELAWARE CO.	<i>La Fargeville</i>	<i>Pulaski</i>
Delhi	<i>Le Raysville</i>	SARATOGA CO.
ERIE CO.	Lorraine	<i>Sandy Hill</i>
Buffalo	<i>Lorraine gorge</i>	Saratoga Springs
GENESEE CO.	<i>Pamela Four Corners</i>	TOMPKINS CO.
Stafford	<i>Perch lake</i>	Ithaca
GREENE CO.	<i>Sanfords Corners</i>	WYOMING CO.
<i>Smith's Landing</i>	<i>Stone Mills</i>	<i>Griswold</i>
	Theresa	
	Watertown	

Index to formations

• Lower Cambrian, 3562	Greenfield limestone, 3573
Potsdam, 3610, 3612	Fort Cassin beds, 3578

Theresa limestone, 3570, 3571, 3572, 3617, 3620	Utica shale, 3595
Potsdam sandstone, 3558, 3568, 3569	Lorraine, 3596, 3597
Chazy limestone, 3576, 3577, 3579, 3581	Hudson river group, 3567
Pamelia limestone, 3574, 3575, 3604, 3605, 3606, 3607, 3608, 3609, 3611, 3613, 3614, 3615, 3616, 3618, 3619, 3621, 3622, 3623, 3624, 3625	Clinton, 3598, 3599
Lowville limestone, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3603, 3626	Salina, 3564
Black river limestone, 3582, 3583, 3584	Bertie waterlime, 3565, 3566
Trenton limestone, 3580, 3585, 3586, 3587	Becraft limestone, 3561
	Oriskany sandstone, 3600, 3601
	Schoharie, 3602
	Stafford limestone, 3559
	Ithaca beds, 3556
	Oneonta sandstone, 3557
	Portage (Cashaqua shale), 3560
	Carbonic, 3563

Record of new localities

- 3556 Ithaca beds. Cornell Heights, Ithaca. Abandoned quarry on the south side of the highway at the foot of the slope below the trolley loop; 270 feet above *Spirifer laevis* zone, 672 ft A. T. C. L. Breger purchase, 1906
- 3557 Oneonta sandstone. Delhi, Delaware co. H. J. Alden purchase 1906
- 3558 Potsdam. Beekmantown passage zone of the Theresa quadrangle. H. P. Cushing coll. 1907
- 3559 Stafford limestone. Stafford. John Gillard, donor, 1907
- 3560 Portage (Cashaqua shale). From concretion in Cashaqua shale in bank of Murder creek near Griswold, Wyoming co. D. D. Luther coll. 1906
- 3561 Lower Becraft (Scutella). Catskill Cement Co.'s quarry, Smith's Landing, Greene co. G. H. Chadwick, coll. and donor
- 3562 Lower Cambric. Swanton, Vt. Ward's Natural Science Establishment purchase
- 3563 Carbonic. Eskdale, New Brunswick, Can. F. Krantz purchase 1907
- 3564 Salina. Upper layers of Shawangunk grit along Erie Railroad, 2½ miles from Otisville toward Port Jervis. H. C. Wardell coll. 1907
- 3565 Bertie waterlime. Buffalo. Ward's Natural Science Establishment purchase 1907
- 3566 Bertie waterlime. Waterville. Ward's Natural Science Establishment purchase 1907
- 3567 Hudson river group. Lebanon, Ohio. Ward's Natural Science Establishment purchase 1907
- 3568 Potsdam (Beekmantown passage beds). Evans Mills, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3569 Potsdam (Beekmantown passage beds). Theresa, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3570 Theresa limestone. Le Raysville, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3571 Theresa limestone (top of). 1¼ mile east of Perch lake, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3572 Theresa limestone. Evans Mills, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907

- 3573 Greenfield limestone. Beeler quarry, Saratoga Springs. R. Ruedemann coll. 1907
- 3574 Pamela limestone (near base). Le Raysville, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3575 Pamela limestone. 1¼ mile east of Perch lake, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3576 Middle Chazy (base). 1 mile north of Plattsburgh. R. Ruedemann coll. 1907
- 3577 Middle Chazy. Sloop island, Lake Champlain. R. Ruedemann coll. 1907
- 3578 Fort Cassin beds. Valcour, Clinton co. R. Ruedemann coll. 1907
- 3579 Lower Chazy. South shore of Valcour island. R. Ruedemann coll. 1907
- 3580 Trenton (lower 50 ft). Below sawmill on Little Chazy river, Chazy. R. Ruedemann coll. 1907
- 3581 Upper Chazy (bottom of). Valcour island. R. Ruedemann coll. 1907
- 3582 Black river (cherty beds). Diamond island, Watertown. R. Ruedemann coll. 1907
- 3583 Black river (middle bed). Diamond island, Watertown. R. Ruedemann coll. 1907
- 3584 Black river (top). Jones's quarry, Chazy, Clinton co. R. Ruedemann coll. 1907
- 3585 Trenton (loose). Valcour island, Clinton co. R. Ruedemann coll. 1907
- 3586 Trenton. Crabb island, Clinton co. R. Ruedemann coll. 1907
- 3587 Trenton (upper third). East Canada creek, Fulton co. R. Ruedemann coll. 1907
- 3588 Lowville (upper). Between Evans Mills and Sanford's Corners, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3589 Lowville. 3½ miles north of Brownville, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3590 Lowville. Section along railroad and south of Sanford's Corners (bottom of cliff). H. P. Cushing & R. Ruedemann coll. 1907
- 3591 Lowville (near top). 1 mile south of Sanford's Corners, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3592 Lowville (upper). Quarry opposite filter plant, Watertown. H. P. Cushing & R. Ruedemann coll. 1907
- 3593 Lowville. Evans Mills, Jefferson co. H. P. Cushing & R. Ruedemann coll. 1907
- 3594 Lowville. Inghams Mills, Herkimer co. R. Ruedemann coll. 1907
- 3595 Utica shale (base). Sandy Hill, Saratoga co. R. Ruedemann coll. 1907
- 3596 Lorraine. Lorraine gorge, Lorraine, Jefferson co. R. Ruedemann coll. 1907
- 3597 Lorraine beds. Pulaski. R. Ruedemann coll. 1907
- 3598 Clinton shale (overlying upper iron ore bed). Clinton. R. Ruedemann coll. 1907
- 3599 Clinton shale (overlying lower iron bed). Clinton. R. Ruedemann coll. 1907

- 3600 Oriskany. Erie Railroad cut, Pine hill near Highland Mills, Orange co. H. C. Wardell coll. 1907
- 3601 Schoharie (upper layers). Erie Railroad cut, Pine hill near Highland Mills, Orange co. H. C. Wardell coll. 1907
- 3602 Schoharie. At edge of woods about 300 yards north of Erie Railroad cut at Pine hill near Highland Mills, Orange co. H. C. Wardell coll. 1907
- 3603 Lowville (base). $\frac{1}{2}$ mile northeast of Le Raysville, Jefferson co. H. P. Cushing coll. 1907
- 3604 Pamela limestone (base). La Fargeville, Jefferson co. H. P. Cushing coll. 1907
- 3605 Pamela limestone (base). $\frac{1}{2}$ mile east of La Fargeville, Jefferson co. H. P. Cushing coll. 1907
- 3606 Pamela limestone. 2 miles south of Stone Mills, Jefferson co. H. P. Cushing coll. 1907
- 3607 Pamela limestone. 1 mile east of Stone Mills, Jefferson co. H. P. Cushing coll. 1907
- 3608 Pamela limestone (base). Evans Mills, Jefferson co. H. P. Cushing coll. 1907
- 3609 Pamela limestone. 2 miles southwest of La Fargeville, Jefferson co. H. P. Cushing coll. 1907
- 3610 Potsdam sandstone. Indian River 3 miles north of Evans Mills, Jefferson co. H. P. Cushing coll. 1907
- 3611 Pamela limestone (base). $\frac{1}{4}$ mile south of Evans Mills, Jefferson co. H. P. Cushing coll. 1907
- 3612 Potsdam sandstone. 2 miles west of Theresa, Jefferson co. H. P. Cushing coll. 1907
- 3613 Pamela limestone (base). 1 mile east of Perch lake, Jefferson co. coll. 1907
- 3614 Pamela limestone (base). 1 mile northeast of Perch lake, Jefferson co. H. P. Cushing coll. 1907
- 3615 Pamela limestone (base). 3 miles east of Perch lake, Jefferson co. coll. 1907
- 3616 Pamela limestone. 1 mile east of Pamela Four Corners, Jefferson co. H. P. Cushing coll. 1907
- 3617 Theresa limestone. 2 miles north of Perch lake, Jefferson co. H. P. Cushing coll. 1907
- 3618 Pamela limestone (base). 1 mile east of Perch lake, Jefferson co. H. P. Cushing coll. 1907
- 3619 Pamela limestone. 1 mile northeast of Evans Mills, Jefferson co. H. P. Cushing coll. 1907
- 3620 Theresa limestone. 2 miles northeast of Perch lake, Jefferson co. H. P. Cushing coll. 1907
- 3621 Pamela limestone (base). 1 mile northwest of Perch lake, Jefferson co. H. P. Cushing coll. 1907
- 3622 Pamela limestone (base). 2 miles northwest of Evans Mills, Jefferson co. H. P. Cushing coll. 1907
- 3623 Pamela limestone (base). 2 miles east of Perch lake, Jefferson co. H. P. Cushing coll. 1907

- 3624 Pamela limestone (base). $2\frac{1}{2}$ miles north of Evans Mills, Jefferson co. H. P. Cushing coll. 1907
 3625 Pamela limestone. 1 mile west of Evans Mills, Jefferson co. H. P. Cushing coll. 1907
 3626 Lowville limestone (base). 1 mile west of Le Raysville, Jefferson co. H. P. Cushing coll. 1907

Record of foreign localities

Specimens bearing lemon yellow tickets

- 255 Siluric. Lövenich, Rhenish Prussia. F. Krantz purchase
 256 Lower Siluric. Königshof, Germany. Ward's Natural Science Establishment purchase
 257 Cambric. Skrej, Bohemia. Ward's Natural Science Establishment purchase
 258 Lower Siluric. Osek, Bohemia. Ward's Natural Science Establishment purchase
 259 Siluric. Beraun, Bohemia. Grebel, Wendler & Co. purchase
 260 Siluric. Gothland, Sweden. Grebel, Wendler & Co. purchase
 261 Siluric. Dudley, England. Grebel, Wendler & Co. purchase
 262 Devonic. Ferrones, Spain. Grebel, Wendler & Co. purchase
 263 Siluric. Drabow, Bohemia. Grebel, Wendler & Co. purchase
 264 Siluric. Rotziküll, Island of Oesel, Baltic sea. Grebel, Wendler & Co. purchase
 265 Upper Siluric. Rotziküll, Island of Oesel, Baltic sea. F. Krantz purchase
 266 Devonic. Forfarshire, Scotland. F. Krantz purchase
 267 Siluric. Gera, Thuringia, Germany. Grebel, Wendler & Co. purchase
 268 Siluric. Westmoreland, England. Grebel, Wendler & Co. purchase
 269 Siluric. Skellgill Beck, Ambleside, England. Grebel, Wendler & Co. purchase
 270 Siluric. Goni, Sardinia Island, Mediterranean sea. Grebel, Wendler & Co. purchase
 271 Siluric. Vallongo, Portugal. Ward's Natural Science Establishment purchase
 272 Lower Siluric. Isvos on the Walchow, Russia. Ward's Natural Science Establishment purchase
 273 Lower Siluric. Angers, France. Ward's Natural Science Establishment purchase
 274 Cambric. Andrarum, Sweden. Ward's Natural Science Establishment purchase
 275 Lower Devonic. Eifel, Germany. Ward's Natural Science Establishment purchase
 276 Lower Siluric. Hostin, Bohemia. Ward's Natural Science Establishment purchase
 277 Lower Siluric. Étage D, d₁ sta. Benigna, Bohemia. Ward's Natural Science Establishment purchase
 278 Lower Siluric. Étage D, d₅. Lejckov, Bohemia. Ward's Natural Science Establishment purchase

- 279 Devonic. St German le Fouilloux, Mayenne, France. F. Krantz purchase
- 280 Devonic. Rhisnes, Belgium. F. Krantz purchase
- 281 Cambric (Shineton shales). Shropshire, England. F. Krantz purchase
- 282 Lower Siluric. Girvan, Scotland. F. Krantz purchase
- 283 Upper Siluric. Muirkirk, Scotland. F. Krantz purchase
- 284 Siluric. Naninne, Namur, Belgium. F. Krantz purchase
- 285 Lower Permian. Nürschan, Bohemia. F. Krantz purchase

THE BEGINNINGS OF DEPENDENT LIFE

BY JOHN M. CLARKE

For a number of years the writer has endeavored to assemble material from the older faunas which might illuminate the incipient expressions of dependent life. It is through this avenue only that the problem of the origin of the symbiotic conditions which now pervade all nature can ultimately be approached with hope of resolution.

The dependent condition of individual existence is one of the manifold presentments of organic adaptation which is to be comprehended best by comparison of the complicated conditions prevalent today with their simpler expressions in the early life of the earth. Adaptation is in large measure a sociological problem of immediate concern. It is not proper to consider the more serious features of sociological adaptation as merely analogous to organic adaptation. In human society dependence means simplicity, that is, loss of complexity; it reduces moral independence and induces idleness, beggary, misery and crime. Here is no question of analogy, but rather of continuity of mode, of cause and effect, penetrating human society. Such laws as govern its fundamental and primary manifestations are to be sought in the primitive life of the earth.

I am fully aware of what extensive data are essential to adequate conclusions in this inquiry and how far-reaching the bearings of the inquiry must be. At this time I should go no further perhaps than to point out some of the very numerous and most instructive expressions of these conditions which it has been practicable to bring together, abiding in the hope of eventually collating more copious data. I shall not go too far, however, in suggesting certain obvious inferences which seem entirely justified by these data and by the general principles of adaptation.

Dependent life, whether expressed in the often extraordinarily complicated conditions of parasitism, or in more simple symbiotic manifestations such as commensalism or mutualism or still more simply in the merely fixed condition of the individual through the whole or a part of its life, involves conditions of degeneration. These degenerative effects are relative; they may involve an individual in most of its essential organs and functions, a genus, a

family or an entire class of organisms. Such effects may be restricted to only a part or certain parts of an organism and special degenerate organs are recognized throughout the higher forms of nature.

Degeneration follows adaptation. It may be primarily the result of special adaptation in the individual for its own protection producing no more than a condition of fixation. This is degeneracy in essence because it involves dependence. Discovered and perfected by the organism as helpful against its enemies or in the winning of food, it continues into atrophy of organs no longer needed; such atrophy once begun extends to other organs as the adaptation and dependence become more complete, till in the end all the organs in succession become involved in accordance with the lessened demand upon them; the alimentary, the locomotive, the sensory, all except those involving the function of reproduction. Nature is permeated with such degeneration. Few, probably no members of the whole vast fauna and flora of the earth are free of the bond of supporting others at the cost of their own effort and vitality. From the protozoa and bacteria to man and the oak every greater or less division of nature is riddled with these dependent organisms.

The path of evolution is specialization, chiefly by adaptation; only occasionally is evolution progress. The upward march of organic nature is before the eye, palpable, pleading and perspicacious, but degeneracy is largely unseen, impalpable, sequestered and ignored. Often though expressed openly, even throughout great natural divisions, it is not apprehended. Progress involves complication of structure; simplicity of structure too often means derivation by degeneration from the complex rather than initiation of upward advance.

The total result of degeneracy in nature and in human society presents itself to us as the outgrowth of a primitive miscarriage in the normal upward trend of nature which has grown in intensity with the passage of time till now it presents to the philosophic mind the appalling condition of a widespread downward impetus throughout the living world whose tendency is to undermine that which still stands upright. Degenerative tendencies in organic and in social life increase and intensify by their own impetus, like a stone rolling down hill. It has not been shown that there is in nature any power to redeem itself when degeneracy

tive adaptation has once begun, any hope of salvation within the organism or group of organisms, of turning back, recouping and starting again on the upward path. In the face of the counter evidence here set forth, the conclusion is unavoidable that, for a large part of humanity ethical philosophies are inefficient and illusive.

The lines of progress in organic life have steered wide of these dependent existences or have maintained their charted course in spite of them.

Great groups of organisms, classes, orders and subkingdoms have been so permeated by degeneracy of growth that their life, lasting, it may be, from almost the dawn of existence to the present, has had no other outcome than to perpetuate a depraved race. Such a race, however broad its boundaries and long its perdurance, has been entirely outside the general path of that upward advance which has led to the higher expressions of life. I would cite the mollusks as such a great division of organisms. Created free and independent, their almost universal acquisition of shell protection has kept them down to earth or made them grubbers in the mud of the ocean. Only a few of them, by acquirement rather than by endowment, sail the seas, and the floating habit, says a well known writer, is nearly related to the sessile. They have progressed only within the narrow limitations of their own race. Out of them has come nothing better. No lines of progressive evolution lead from the higher organisms back to them, but all pass them by. We do not even know the real relations of the great subdivision of the Mollusca to the molluscoids — the brachiopods and bryozoans; whether these are not degenerative expressions from the early mollusks rather than stages along the line of development to higher molluscan forms. We do know that all have filled the earth and sea of today with representatives in no substantial degree different from their ancestors of the Silurian.

Were we to begin an investigation of the degenerate condition pervading nature and to start with man and his more than one hundred species of parasites, there would be but one conclusion of our excursion; it was clearly stated long ago:—the whole creation groaneth and travaileth.

In the more innocent expressions of symbiosis termed mutualism and commensalism, where associations of organisms are purely

social and apparently harmless or even mutually advantageous to the participants, it is probable that the outcome is infallibly deleterious.

The glass rope sponge (*Hyalonema*) has its coil of rope, by which it anchors itself to the sea bottom, incrustated and shielded by a coral (*Polythoa*), which spreads like a thin wrap of felt all about it, while its ally the Venus Flowerbasket (*Euplectella*) imprisons a crab in its interior behind the bars it throws across its aperture but feeds it with ever changing water currents; worms and anthozoan corals grow together, with the tubes of the former surrounded by the cells of the latter, both sweeping the water currents together for food which may go to either mouth; dead snail shells in which hermit crabs have taken residence are often beset with sea anemones (*Sagartia* and *Adamsia*) whose stinging cells may scare away the enemies of the crab, while the crab favors the fixed anemones by moving his establishment from place to place, thus to new feeding grounds.

All these conditions seem on the surface entirely harmless or positively advantageous to all parties involved; that is advantageous in the sense that they make life easier, less arduous, discourage activity and perfect adaptation. Perfect adaptation, however advantageous to the individual concerned, is the very expression of degeneration in symbiotic life. Throughout nature complete adaptation makes for stability and long life, incomplete adaptation for the restless activity which leads to progress.

The general effect then of all symbiotic conditions is degenerative. They themselves arise from degenerate tendencies and could not exist save that degeneration had already set in. They are expressions of this condition and serve to confirm and transmit this tendency. The fact is tremendously evident that even the most innocent of symbiotic, dependent or attached conditions of growth is the leaven of progressive degeneracy.

It is well known that the critical methods of morphology and embryology have been requisite to determine the original ancestral independence of the most debased of parasites. While the doctors of the middle ages wondered over the barnacles and pictured them as growing on trees, dropping thence to the ground transformed into geese, their real nature as debased crustaceans was not unfolded till the life history of the creatures showed that their early stages were free and predatory, and the adult condition one of extreme adaptation by progressive loss of functions and organs. Thus the parasitic and dependent habit is always preceded by a

free and predatory condition. Once the dependent habit is established the capacity for reaction grows weaker; degenerative adaptation creeps still further back in the life of successive generations and the degradation of the adult state becomes more profound.

The all pervading conditions of symbiosis and dependence in living creatures are largely beyond the reach of our present inquiry. We are endeavoring to seek some clew to the origin of dependent life from its earliest and simplest expressions. The parasitic conditions of the present organic world are complicated in the extreme as a result of progressive and easy adaptation; often two, three and sometimes four hosts are necessary to the full life course of the dependent. Usually these present extreme conditions are expressed only by soft-bodied terrestrial organisms. The evidences of dependent life presenting themselves to the paleontologist must be chiefly of marine origin and wholly adapted to a single host; they must moreover be wholly simple in their expression or may be easily misconceived. There are certain of these simple expressions of long standing; we find them in existing nature and the ancient faunas show that such associations began far back in the history of life. To some of these we shall make special reference. Besides these a multitude of illustrations of dependent and attached forms of organisms can be drawn from every hand in the ancient as well as the recent faunas. They call for no special illustration but they nevertheless enforce our consideration of the origin of this condition.

So far as our facts go there are but few evidences of true parasitic conditions in the Paleozoic faunas. The oldest and clearest is the well known case of the coalition of the limpetlike snail *Platyceras* and the crinoids. The snail settles down at an early age on the dome of the crinoid, placing the aperture of the shell over the anal vent of its host and remains attached for an indefinite period of its subsequent life.

It is clear that the snail depends for its food on the waste from the crinoid and the fact that it remains attached for a very considerable period of its existence is shown by specimens of the crinoid dome bearing successive scars made by the enlarging growth of the mouth of the snail shell. Though this is the most extreme expression of ancient parasitism known to us, it was evidently of a very elastic kind and by no means affected all indi-

viduals of this genus of shells. This combination makes its first appearance in the early Devonian and seems to have become intensified in the great crinoid plantations of the early Carbonic but in either formation the examples of the actual dependent combination are in very slender proportion to the number of individuals of either snail or crinoid. Some of the snails acquired this habit of parasitic dependence, others evidently did not. Apparently it was in some measure an individual adjustment. Yet the more general dependence of this snail *Platyceras* on the crinoids is indicated by the fact that quite generally Paleozoic strata carrying an abundance of the one also abound in the other.

Time has not extinguished this affiliation, for the existing seas afford occasional evidence of similar relation between the limpets and the crinoids. Our material seems to throw some light on the inception of this dependent habit. A crinoid, *Glyptocrinus*, from the Lower Siluric is occasionally found inclosing in its arms a holostomatous snail, *Cyclonema*, not attached to the dome, for the shell had not the limpet habit of attachment, but lying free in such attitude as to get the full advantage of the crinoid's waste.

True dependence is also indicated by a similar association between the crinoids of the Carbonic rocks and the starfish *Onychaster*. The starfish adjusts itself, mouth downward over the anal aperture of the crinoid. Our specimens showing this condition have been caught in this act of feeding. The flexible character of the starfish made the attachment easily subject to change. This association too is one that time has not cured.

Much more abundant than these exhibitions of parasitism are those of the commensal habit as indicated by our illustrations of worms and corals, worms and sponges, barnacles and corals.

In the natural and expected course of procedure commensalism is the precursor of parasitism, and commensal associations became established more abundantly and at an earlier date than the other. Such mutual associations among members of the groups here indicated have been continued till today, not in precisely similar manifestation but in like alliances between individuals of the different divisions.

The protected sedentary condition, effected either by the agency of a special organ, as among most of the old brachiopods during a part or all of their life, or by the cementation of the shell to the rocks or some like object, is so widespread as to here command attention as a still simpler expression of dependent life. That the

attached condition among organisms involves and expresses degeneration and necessarily promulgates still further decline, biologists are well agreed.¹ An argument therefore to show that groups of attached organisms like the corals, the sponges, the bryozoans, are degenerate and that their apparent simplicity of structure is less a primitive than a derived condition, is not here called for.

As we contemplate the earliest faunas of the earth we find that adherent and attached forms of life are in a notably less proportion than in the faunas succeeding. Bryozoans, crinoids, corals, sponges, attached worms are extremely rare; trilobites and brachiopods enormously predominate. The trilobites were crawlers and swimmers. The brachiopods however were of different habit. The predominating forms were the inarticulate species allied in structure to the living *Lingula* and, if allied also in habit, burrowed in the mud of the sea bottom with their fleshy pedicles, potentially not actually attached. Some of the genera with long pedicle sheaths may not have had this habit but have been actually attached to solid objects by their arm; this was undoubtedly the habit of the articulate brachiopods also until the time came with the maturity of these creatures when the arm was atrophied and they fell back on the sea bottom, free but still incapable of locomotion. In this condition, like many bivalves (e. g. *Mya*, the soft-shelled clam, which lies buried in the mud with no power to get any way but further in) they were potentially attached though actually independent.

To the faunas earlier than the Cambrian with their probable decrease of attached organisms, we can not appeal. We can, however, still follow the line of our argument into those earlier faunas which still remain unrevealed.

In all shell bearing organisms the shell is not a primitive but a secondary development. Primitive organisms, as all considerations of biology insist, were shell-less throughout their existence — a conclusion not only indicated by ontogeny but by philosophy. The generally accepted conception that the archetype of organic life was a naked free-swimming pelagic creature may be supplemented by the proposition that the primitive condition of all organisms even after departure from the radicle was still naked and free. We must conceive that only as the independent soft-bodied animals of the earliest

¹See especially Arnold Lang. *Einfluss der festsitzenden Lebensweise.*

faunas adapted themselves to life in shallow waters did the necessity for shell protection arise for with this change from a free-swimming to a creeping or stationary littoral habit came the lessened capacity for escape by locomotion. As Lang has said, the coast is full of dangers; the waves beat violently against it, the regularly returning tide keeps the waters ever moving. From these attacks of nature's blind forces the creatures must protect themselves. Some, in times of stress, seek deep water, some scuttle into protected spots or bury themselves in the sand, and others catch hold of stable bodies, attaching themselves by suction or fixation. But all these resorts are inefficient without the addition of shell protection; that once achieved, the animals may rejoice and flourish in the play of the waves which brings them nourishment with decreased exertion on their part. The primary step toward a degeneration which in the lapse of ages has led to the dependent life conditions of today would seem with reason to lie in the forced reduction of this locomotive power and adaptation to a sedentary condition resulting in the necessity for the formation of a protective shell.

ILLUSTRATIONS OF PALEOZOIC SYMBIOTIC ASSOCIATIONS

The instances here given are some of the more instructive occurrences of this sort that have come under my notice. They are not in all cases common though they exemplify consociations which are familiar in like groups of the living world. The record of their number will doubtless be much increased as such objects come under closer observation. The collection of such data from the early periods of the world's life is not likely to be carried too far for it is here, rather than in a profuser and much more complicated later development, that the factors of symbiosis are the more easily legible.

Worms and Corals

The coexistence of the tubicolous worms with the corals is one of the commonest phenomena of present seas. It became established at a very early stage in the earth's history and in the Devonian coral reefs the habitude had already become widespread and varied. It was palpably less frequent in Silurian times, at least our material would so indicate, and when it does present itself, the expression is quite simple. In most cases it is an elementary expression of commensalism. Worm and coral may start to grow together di-

rectly on settling down from the free larval state, or conjunction may be formed by attachment of the annelid larva after the growth of the coral has well progressed; in both cases the growth of the latter engulfs the former save at its tentacled aperture.

The coral *Zaphrentis* or *Cystiphyllum* and the worm *Gitonia corallophila*. I give this latter designation to what appear to be chiefly straight worm tubes found in simple cyathophylloids such as those mentioned. The worm has attached itself at any stage of the coral growth and quite often its tubes are found projecting in considerable number from the calyx of the coral disordering the septa by its thickened stereom and taking just the position most advantageous to its feeding with the help of the coral's tentacles [pl. 2, fig. 1]. Often these tubes seem to puncture the thecal walls of the coral where actually they have become overgrown or left behind by the increase of coral substance. It is not usual to find both of these conditions in one corallite. Plate 2, figure 3, shows a *Zaphrentis* with a series of small worm apertures at its base; figure 2 is an enlargement of the thecal wall of *Zaphrentis* with two apertures one of which shows distinctly the wall of the tube; figure 4 is a *Cystiphyllum* with apparently short-lived worm tubes established at different growth stages of the coral. In figures 5, 6 of the same plate are two views of a tube both ends of which seem to open into the calyx of a small *Zaphrentis*. If I interpret the growth of this worm correctly it started almost concurrently with the coral and like the worm on *Pleurodictyum* kept both ends up. It will be seen by examination of these figures that the course of the worm tube is singularly erratic; both branches have kept close to the margin of the calyx, one has come pretty straight up, while the other in its late stages made almost a half circuit of the calyx.

All the examples above cited are from the Onondaga limestone of the Lower Devonian.

The corals *Monticulipora* and *Stromatopora* and the worm *Gitonia siphon*. These compact, stony, massive structures covered with thousands of arms reaching out for new supplies of nourishment, seem to have especially invited the settlement of straight tubed worms which, for convenience, are designated as *Gitonia siphon*.

A very striking example is that illustrated in plate 1, figure 4, where the coral has overgrown the face and eyes of a moulted head shield of the trilobite *Dalmanites* and a series of worms has started

growing obliquely upward from the very beginning of the coral (*Monticulipora*) growth. This specimen is from the Onondaga limestone.

A very similar combination is shown in figure 3, plate 1, which represents a colony of *Favosites sphericus* (Helderbergian) with worms of like character. Figures 1, 2 are of a *Stromatopora* from the Cobleskill (Uppermost Siluric) limestone, one showing the worm apertures on the weathered surface, the other being a polished face of the same specimen with many cross-sections of oblique tubes.

The tabulate coral *Pleurodictyum*; the worm *Hicetes innexus*; a sponge, and the gastropod *Loxonema* (sometimes *Pleurotomaria*) or the brachiopod *Chonetes* [see plates 3, 4]. This is a very remarkable and most instructive combination and we have illustrated it quite fully on the accompanying plates. The combination of the coral and the worm has long been known and the sandstone casts of the base of *Pleurodictyum* with the "coiled central body" or "wormlike object" are common in the Lower Devonic (Coblentzian) of Germany and have frequently been illustrated.

Pleurodictyum is a compound coral growing in small lens shaped colonies with large cells and the genus is widely distributed in faunas of Lower and Middle Devonic time. We may mention *P. lenticulare* Hall of the Helderbergian of New York and its variety *laurentinum* of the Grande Grève limestone of Gaspé; *P. convexum* Hall, Onondaga limestone; *P. problematicum* Goldfuss of the Coblentzian; *P. constantinopolitanum* Archiac and Verneuil, from the lowest Devonic of the Bosphorus; *P. amazonicum* Katzer of a similar age in the Amazonas and *P. styloporum* Eaton from the Middle Devonic Hamilton shales of New York. The concurrence of the coral and its convoluted worm has been noted in several of the species here mentioned but the varying degree of its frequency is instructive. Thus in the earliest species, *P. lenticulare*, I have seen the worm tube very rarely, after the examination of a considerable number of examples; in the var. *laurentinum* not at all; never in the large species *P. convexum* Hall of the Onondaga limestone. The single illustrations of *P. amazonicum* and *P. constantinopolitanum* show its presence but enable one to form no conception of its prevalence. The combination is frequent enough in *P. problematicum* to have given rise to the specific name of the coral. The Middle Devonic *P. stylo-*

porum has afforded the material for most of the illustrations here given. Of this very common species in the calcareous shales of the Hamilton I have been able to critically examine several hundred individuals and it is safe to say that the worm is present in the majority of examples. It is easy to determine its presence on inspection of the tentacular surface of the coral by the contrast between its round tubes and the angular coral cells. All the specimens here figured to show the convolutions of the worm have been drawn from actual preparations.

The history of the combination in *P. styloporum* is as follows: At the close of the free-swimming larval stage the coral, in fully eight cases out of ten, selected and attached itself to a dead or living shell of the gastropod *Loxonea hamiltoniae*. Directly upon fixation or even actually contemporaneous with it was the attachment of the larval worm upon the incipient coral or alongside it. In many cases, such as that illustrated in plate 4, figure 3, the worm tube is directly fixed to the gastropod; again it may be free of the gastropod, and separated from it by the thickened basal theca [see pl. 4, fig. 1, 2]. With the multiplication of cell growth and the upward trend of the coral, the worm began its convoluted growth, its tube growing as much at one end as at the other. Some of the existing serpulid worms have their eyes on the hinder end of the body at the tentacular surface; it is fair to presume that at this early period this advanced stage of degeneracy had not been reached and the tube was thus kept open at both ends. In view of the regularity of coiling shown in some of the commensal worm tubes it is interesting to notice that in this case the worm after making a start, gets its double coil into parallelism for a half to an entire turn and then each arm starts off into a direct course following the radial path of the coral cells. These branches often pass in and out between the cells, keeping their extremities always at the tentacular surface and very seldom is there evidence of the worm encroaching on the polypite cells. Still this may occur and the worm tube occasionally becomes encased by a young polypite and holds a position in the center of the cell [pl. 4, fig. 4].

There may be other worms encased in the thickened base of this coral as shown in figures 1, 2, plate 4, but it is not yet clear where their apertures lie as I have never seen but two annelid openings at the surface of the adult coral. It is quite possible that originally opening on the tentacular surface at an early stage of coral growth

they have been buried in the later accumulations of stereom. There are long tubular passages between the corallites in early growth stages which have not been described in the structure of this coral genus and in sections these are confounded with worm tubes but in etched specimens such as have here principally served for illustration, their nature is clear.

In this interesting combination there is still another member—a small calcareous sponge. It has come to my notice several times. The one here figured was taken from the tube of the worm but whether that is its usual position or whether it may seat itself in one of the coral calyces or whether indeed it is a usual member of the consociation can not clearly be regarded as established.

I have given (pl. 4) some illustrations which show how readily the dead parts of these organisms become incrustated with serpulid worms. Figure 8 is the surface of a part of a dead *Loxonema* to which a *Pleurodictyum* had grown and figure 7 shows the inside of an old tube of the commensal worm *Hicetes innexus*, itself incrustated with minute worm tubes.

Interesting as is this instance of commensalism, its most extraordinary feature is the amazing evidence of selection by the larval coral of the body to serve as the base on which it is to grow. I have stated above that a very evident majority of the colonies of this coral *Pleurodictyum* as it occurs in the Hamilton shales are attached to an organic object and that this organic base in approximately 80 per cent of the cases is a shell of *Loxonema hamiltoniae*. Occasionally the shell may be a *Pleurotomaria* of one or another species. I have no record of its being any other than one of these gastropods. On the other hand the German *Pleurodictyum problematicum* fixes itself by decided preference to the brachiopod *Chonetes sarcinulatus* Schlotheim. I have examined a considerable number of specimens of this Coblentzian species but have seen no other shell used for attachment nor have I found record of any other. Though I can not use percentages with reference to the frequency of this occurrence, this palpable fact remains that as between these two closely allied if not identical corals, one selects a gastropod, the other a brachiopod as its base of attachment. Emphasis is to be put on the word "selects" for among the brilliant examples of selective adaptation none could be more striking than this. The floor of the New York ocean was covered with *Chonetes* and of the German ocean with gastropods during the life of this coral. Were either wanting in the other fauna, hundreds of other species of organisms lined the sea bottom. The coral was not deprived of its choice.

Taken as a whole this combination is very complicated commensalism from a date so ancient as the Devonian, more extreme than any other yet known from the Paleozoic rocks. But we find a somewhat parallel case in the present described by Bouvier as occurring in the Gulf of Aden — a coral and a worm growing together, and hidden in the coral substance a gastropod on which both settled down when the partnership began; furthermore there appears to be a small bivalve in association with the worm. Other somewhat similar cases might be cited.

The Devonian coral *Acervularia* and the spiral worm *Streptindytes acervulariae*; a Silurian *Stromatopora* with a somewhat similar spiral worm, *Streptindytes concoenatus*; a Devonian *Stromatopora* with the spiral worm, *Streptindytes compactus*. The first of these occurrences was described some years ago by Prof. Samuel Calvin [On a New Genus and Species of Tubicolous Annelida. *Am. Geol.* 1:24. 1888]. It is the case of a large annelid whose tube measures $\frac{1}{2}$ to $\frac{1}{4}$ inch in diameter growing upward in numbers among the cells of the compound coral *Acervularia davidsoni* Edw. & H. from the Middle Devonian rocks of Iowa. The species has not before been illustrated and I have to thank Dr. Calvin for the privilege of introducing the accompanying cut of this interesting commensal [pl. 1, fig. 7].

Another example of these spiral commensal worms (*Streptindytes concoenatus*) is afforded by the *Stromatopora* reefs of the Cobleskill limestone (Upper Silurian). The illustration here given [pl. 1, fig. 5, 6], affords some idea of how a small mass of *Stromatopora* may be quite riddled with these minute corkscrews. This is taken from a single section across a small colony in which it is apparent that these worms have become sessile at different stages of growth in the coral mass as they start at different levels in the colony. It is also clear that the worm tube made at least one horizontal convolution before starting on its upward spiral growth and it is more than likely that its elongated spiral is due to the requirement of keeping its tentacular end up at the feeding surface of the growing coral. These tubicolous worms have very plastic tubes and readily adjust themselves to surroundings. In the worm of *Pleurodictyum* (*Hicetes innexus*) the early spiral form was soon lost, perhaps because the corallites are so large and close that such growth was effectually obstructed. I have given here some

illustrations of a worm from the Hamilton group described by Hall as *Spirorbis angulatus* from closely attached examples showing but one or two entirely horizontal volutions. These silica etchings show how quickly in later growth the tube departs from the horizontal position and draws out into a loose spiral even when not confronted by the necessity of keeping its feeding end on a level with that of some companion organism [pl. 2, fig. 8-11].

The third of these combinations is illustrated by a specimen for which I am again indebted to Professor Calvin. A little colony of *Favosites* has had its tentacular surface entirely overgrown with a *Stromatopora*. Within the substance of the *Stromatopora* is a multitude of spiral worm tubes not stretched out into loose volutions as in the other instances mentioned, but keeping their two or three volutions in close contact and resembling an *Autodetus* without its external smoothly sloping surface. The edges of these tubes are apparently always angular. These little worms have started growth anywhere on the substance of the *Stromatopora* and instead of growing like a *Spirorbis* with whorls broadly attached for a turn or two, have coiled closely upward and ceased growth in every case very abruptly. This case is singularly instructive as showing that the worm failed to keep pace in growth with the coral and confessed its natural limitations of growth, while in the other cases cited the worm apparently has had the ability to adapt itself to this upward growth by stretching out its tube into loose curves and keeping its aperture always clear at the surface. The little *Streptindytes compactus* however was not equal to this struggle for existence except as it planted its successors in-



Stromatopora with embedded spiral annelid tubes. *Streptindytes compactus*, located at various stages of the growth of the coral. The character of the annelid tube is shown in the enlargement at the right (x 5). The *Stromatopora* has entirely overgrown a small *Favosites* colony. Middle Devonian, Iowa

discriminately over the coral at its various levels of growth. How well it struggled to maintain itself is indicated by the presence of fully 30 individuals on a surface of this coral 2 inches square. The single specimen of this species observed is from the Middle Devonian Cedar Valley beds at Iowa City, Iowa.

Worms and Sponges

We find in more than a single instance among the fossil hexactinellid sponges of the family Dictyospongidae evidences of worm tubes attached to the inner wall or cloaca of the sponge and living in a condition of commensalism. Such worms have been observed in the species *Hydnoceras tuberosum* var. *glossema* and *Prismodictya telum* Hall & Clarke, from the sponge plantations of the Upper Devonian in western New York [pl. 5, fig. 1, 2]. In a considerable number of individuals of the latter species from the same locality nearly all showed the presence



of the annelid commensal and as the surface of the impression left in the sands by the worm tube is in all cases crossed by the reticulated skeleton of the sponge it is inferred that the position of the

former was internal. These are silicious sponges allied to *Euplectella* and though we find no parallel expression of commensalism in the living glass sponges, yet *Euplectella* carries a parasite in the form of a crustacean which in youth enters its open cloacal cavity and remains there so that when the sponge has in adult growth built the terminal or sieveplate over its aperture the crustacean is wholly and permanently caged.

A very commanding illustration of the association between the sponges and spiral annelids is afforded by a series of specimens displayed in the British Museum. These I am able to reproduce here by the kindness of the trustees of that Museum from photographs made by permission of the Keeper of the Department of Geology, through the friendly agency of Dr F. A. Bather. In all these specimens it would appear that the worm, which has made a tube of large dimensions, began its commensal existence early in the life of the sponge and has coiled upward in a very loose spiral about and just within the cloacal wall. Of the figures given here two



These and the figure on the preceding page represent silicified sponges with spiral annelid tubes from the English Chalk. In the upper figure (locality unknown) and the lower right-hand figure (Beckhampton), the exposed worm tube is coiled about a vertical tube which appears to be the silicified wall of the cloaca. These spirals are obviously in reversed direction. The lower left-hand figure is a direct print from a thin section of another sponge in which the position of the worm tube, cloaca and concentric structure of the sponge are shown. Prepared by Dr. Bather. Figures about natural size. British Museum (Natural History) Department of Geology: A. 475: 55117

are of specimens so broken as to expose the interior. Solid flint has replaced the outer part of the sponge body, but in the disintegrated silica of the interior the tube of the cloaca stands vertical with hardened walls about which the worm tube seems to coil like a beanstalk on a pole. The transparent section which is reproduced from a direct print, shows with probably more accuracy the actual distance of the tube from the cloaca. It is extremely instructive to note that the direction of coiling is unlike in the two specimens exposing the spiral, while in the section it would be impossible to determine whether the course of the coiling is dextral or sinistral.

Barnacles and Corals

The barnacles of today express to us one of the extreme results of modification through adaptation to a parasitic condition. I have ventured to suggest on a previous occasion that the Siluric barnacles of the genus *Lepidocoleus* [pl. 5, fig. 3] are an expression of these creatures before such modifications set in. It is regularly segmented throughout its length, its biserial row of plates being open on one side only for the protrusion of the appendages. The forms known as *Turrilepas*, *Plumulites* and *Strobilepis* of the Devonian, are not of greatly different structure. We know however of fully modified acorn barnacles in the Devonian *Protobalanus* and *Palaeocreusia*. The latter is parasitic on a Favosite coral of the Onondaga limestone (Lower Devonian), in which it appears to be embedded by the overgrowth of the polypites rather than by burrowing its way into the colony as do sometimes the acorn barnacles of the present [pl. 5, fig. 4, 5].

Crinoids and Cystids with Gastropods

We are here presented with what appear to be instances of genuinely dependent parasitism—where an attached organism relies upon its host for its nutriment and existence. They constitute the earliest instances we can cite of a dependence between organisms that has become essential rather than merely convenient and it is of extraordinary interest because we find some clue here to the origin of the habit. The attachment of the limpetlike gastropod *Platyceras* to the calyx of the crinoid of the Paleozoic has already been referred to and many instances of it have been cited

and illustrated.¹ This attachment is so effected that the mouth of the shell is seated directly over the anal aperture of the crinoid so that the former may catch the digestal waste of the latter. Upon this waste the *Platyceras* palpably sustains itself. So many instances of this conjunction have passed under examination that no question can arise as to the fact that such attachment is solely for feeding purposes. Suggestions which have been occasionally made that the attachment is rather accidental than otherwise, as attachment to some substantial object is the habit of the gastropod, are not borne out by the evidence afforded by multitudes of these cases. It is quite certain, however, that in the Devonian and Carbonic faunas where this habit became most prevalent, there was always a predominant percentage of the gastropods that did not lend themselves to it; nor have we reason yet to conclude that the habit once inaugurated necessarily continued during the remaining life of the individual. It did continue for a considerable period of the shell's existence as the very instructive figure 6 on plate 6 indicates, the concentric scars being the successive impressions of the lip of the shell as its growth enlarged, while its position relative to the after opening of the crinoid is unaltered.

The history of this form of dependence is extraordinary and illuminating. Throughout the Silurian the crinoids and cystids abounded but mollusks of the limpetlike construction of *Platyceras* were few. Moreover the crinoids were for the most part built with slender domes well hedged about by delicate arms, and on these domes the mollusk might have found difficulty in securing a footing.

The earliest intimation of the tendency on the part of a mollusk to seek its food from the rejectamenta of the crinoid is afforded by an example of a Lower Silurian *Glyptocrinus* which holds within its arms and in a feeding posture a shell of the holostomatous gastropod *Cyclonema bilix*. One might regard the occurrence accidental if it had not been observed more than once.

In the Upper Silurian, *Platyceras* had become somewhat more abundant but its numerical development did not reach that of the allied mollusk *Diaphorostoma* and in plate 6, figure 1, we have an illustration of a small shell of this latter genus attached over the after of the cystid *Caryocrinus ornatus* (Rochester shale). Thus far in time no examples have come to our observation of

¹See particularly C. R. Keyes. Synopsis of American Carbonic Calyptraeidae. Acad. Nat. Sci. Phila. Proc. 1890. p. 150. The author here records a long list of these parasitic associations and especially indicates the effect of this condition in modifying the aperture of the gastropod.

attachment between *Platyceras* and the crinoids. With the opening of the Devonian the development of *Platyceras* became enormous, so much so that the calcareous phase of the earliest Devonian has been termed the *Platyceras* stage. The crinoids also were common at this time, but cases of any dependent conjunction of the two are extraordinarily rare; the only instance of this early date known to me is that cited by Drevermann from the Coblenzian. Little by little, however, the habit was assumed and becoming more frequent in the Middle Devonian it seems to have attained a culmination in the faunas of the earlier Carboniferous. During all the ages which have intervened between the



Silicified specimens of *Platyceras* attached to the dome of *Megistocrinus farnsworthi* White, from the Middle Devonian of Iowa. The perfect adjustment of the shell to the crinoid is seen in the adaptation of its margin to every irregularity of the surface of the dome. Loaned by Prof. Samuel Calvin

Paleozoic and the present there is no record which has come to my notice to prove that this ancient habit has had an uninterrupted existence. The crinoids and the limpets have continued and certainly the detailed records of Mesozoic and Cenozoic faunas should have given some account of this habit had it perdured. We have remarked that the consociation was always an easy one to which even at its height not all the members of the genus *Platyceras* were compelled. In the absence of demonstration, it may be fair to hold it possible that the descendants of these mollusks really abandoned this form of attachment and rebounded from the degenerative condition which it involved; this would be a fact of profound significance if it indicates that an organism once started on the downward path can take a new hold of life and regain its independence. Yet we are doubtless not justified in such a conclu-

sion. In the present seas all gastropods of truly parasitic habit are parasites on the Echinoderma, the class to which the crinoids belong. Crinoids are few today and appear to be relatively free from these attachments, but their allies, the starfish and sea urchins, are still beset by the gastropods, often so reduced by the degeneration of their condition as to be scarcely recognizable. This far-reaching and general condition of depravity would seem a direct inheritance of the ancient conditions we have portrayed.¹

Crinoids and Starfish

We have some very interesting instances of association between the crinoids and the ophiuran *Onychaster flexilis* Meek & Worthen. Three of these are here figured, one a copy from Wachsmuth and Springer's figure of *Actinocrinus multiramosus* W. & Sp., the others drawn from specimens in the possession of Mr Fred Braun. In the first the starfish has encircled with its arms the dome of the crinoid, mouth downward in such an attitude as to suggest though probably not to demonstrate that it was diligently attending to the waste of the crinoid. As the arms of the crinoid have been broken away the act of the starfish is exposed in all its nakedness. In the specimens of the *Onychaster* with *Barycrinus hoveyi* Hall, the arms of the two creatures have become completely entangled and fixation for feeding purposes at least is entirely effective. In respect to the end sought and attained this condition is one of parasitism but one still subject to the control of the individual. There seems no reason to assume that the starfish is here endeavoring to suck the life out of the crinoid itself and it would be going further than the facts justify to interpret this demonstration solely as an act of feeding like that of the common starfish of today in its attacks upon the oyster.

I quote here some remarks from Wachsmuth and Springer's *North American Crinoidea Camerata* [1897, p. 566], concerning the relations of *Platyceras* and *Onychaster* to the high domed crinoid *Actinocrinus multiramosus*.

Of this large and beautiful species we obtained at Indian Creek and Canton over forty specimens, most of them in excellent preservation, with the arms attached; and it is very remarkable that nearly one half of them have either a *Platyceras* attached to the

¹The brothers Sarasin have described a very interesting case of the parasitic attachment of a limpetlike *Platyceras* to a living starfish, in which the former by an extension of its mouth into a snout which penetrates the test of the starfish, sucks out the nutritious fluids *Ergebniss einer Forschungsreise auf Ceylon, v. II*. While the parasitic condition between the limpets and crinoids of the Paleozoic was elastic, this is fixed and beyond repair. Other living snails parasitic on the allies of the crinoids are interestingly described in the *Naturwissenschaftliche Wochenschrift*, January 27, 1904.

tegmen, or a specimen of *Onychaster* between the arms and coiled around the anal tube. This, so far as we know, is the first instance in which a *Platyceras* has been found in contact with a Crinoid with a long anal tube; in all cases heretofore noticed the Crinoid had an anal opening directly through the tegmen, and the Gastropod was fastened invariably with the anterior portion of the shell over the opening. This led to the supposition, for which there seemed to be good reasons, that the Mollusk obtained its nourishment, in part at least, from the excrements of the Crinoid. This, however, was impossible in the case before us, where the anal tube, with the anus at the distal end, extends out far beyond the tips of the arms, and, so far as observed, bends abruptly to one side, so that neither the opening nor the refuse matter could have been in contact with the Mollusk.

In more frequent association with this *Actinocrinus* is the *Onychaster*, and it is worthy of note that this species of ophiuran is rarely found by itself. Nor has it been observed at Indian Creek on any of the other Crinoids, while at Canton it appears also on most of the specimens of *Scytalocrinus robustus* (Hall), a species with a large ventral tube, and the anus located far down at the anterior side; but with this exception we have not seen it on any other species. The fact that this Ophiurid is only found associated with certain species, and there always under similar conditions, and the frequency of this occurrence, would seem to indicate that the position between the arms of these crinoids was its favorite resting place, in which it either found protection, or some special facility for obtaining nourishment.

These specimens are from the Crawfordsville limeshale of the Lower Carbonic (Mississippian).

Crinoids and Myzostomum

All the known living species of the minute wormlike creature *Myzostomum* (60 to 70 in number) are parasitic on the crinoids whereon they form galls or swellings by the overgrowth of the test. Similar galls have been noted on both Mesozoic and Paleozoic species of crinoids by Bather, Shipley, Fraas and other writers, and they are generally ascribed to the *Myzostoma*.

Coral on a Coral

The case of *Caunopora*. It is now quite generally conceded that *Caunopora* which has commonly been regarded as a hydroid coral like *Stromatopora*, but with sharply defined, definitely walled tubes, is actually a laminate hydroid overgrowing a series of erect tubes like those of *Syringopora* or *Aulopora*, carrying oblique dissepiments within. *Caunopora placenta* Phillips is a Devonian species.

Fistulipora occidens presents a similar coalition of a hydroid coral and the primitive tubulate *Aulopora*. This species was described from the Upper Devonian Lime Creek shales of Rockford, Iowa, by Hall [N. Y. State Mus. 23d Rep't. 1873. p. 228, pl. 10, p. 9, 10] who recognized the fact that the large pores on the surface of the coral are projecting tubes of *Aulopora*. An interesting feature of this concurrence is that colonies of the *Fistulipora* are quite as frequently without the *Aulopora* as with it.

One may compare with these instances the interesting case mentioned by Whitfield of the recent coral *Ctenophyllia*, entirely inclosed by a hemispherical growth of *Meandrina labyrinthica* (described in Am. Mus. Nat. Hist. Bul. 1901. 14: 221).

In addition to the instances given above of actual commensal conditions, I am taking this occasion to append a brief account of certain ancient pseudoparasitic organisms of boring habit. These come frequently under the eye of the paleontologist but very little attention has been given to them, occasional incidental references being for the most part the sum of our knowledge of the Paleozoic expressions. The literature of the later formations contains random accounts of such organic relics but I should be going too far afield in this instance to make definite allusion to these.¹

These boring bodies infesting the dead shells which form a large part of the material of the paleontologist are very likely to be either minute algae or fungi, or sponges of genera producing similar effects to the living *Cliona* or *Vioa*. The work of the former has had some notice [see Duncan Quar. Jour. Geol. Soc. 1876. p. 205; Kölliker. Zeitschr. Wiss. Zoolog. 1859, 10: 215; Loomis, N. Y. State Mus. Bul. 39. 1900. p. 223] and their tubules are recognizable by contrast by their microscopic size and the occasional presence of hyphal swellings. The total amount of deterioration and disintegration of skeletons caused by these minute organisms was doubtless great even in Paleozoic times.

The work of boring sponges, however, on ancient organisms has been a far more effective cause of destruction and waste of dead shells. There are certain conditions of preservation in which these borings enforce themselves on the attention, especially when the student has to deal with an arenaceous matrix from which all the calcareous matter of the shells has been dissolved leaving sharp

¹Very instructive instances of these later expressions are cited in a recent paper by E. Schiltze, Die bohrenden und schmarotzenden Fossilien der schwäbischen Meeresmolasse, Jahresb. d. Ver. f. vaterl. Naturk. in Württ. 63, 1907. p. 81-84; Bericht ueb. 29 Versamml. d. Oberrhein. geolog. Vereins zu Wörth, 1906; Zeitschr. f. Mineral. Geol. u. Palaeont. Jahrg. 1.

and clean casts of the borings; or when these natural conditions are reproduced artificially by removing the calcareous material from a lime shale.

Probably the first attempt to characterize with a definite name these undoubted sponge borings was that of McCoy [Brit. Paleoz. Foss. 1855. p. 260, pl. 1B, fig. 1, 1a] who illustrated under the name *Vioa prisca* a series of simple straight club-shaped casts of borings occurring in the shell substance of the pelecypod identified as *Pterinea demissa* Conrad of the Upper Siluric. It is probably safer not to designate these sponge relics by the name of any genus now living and I propose, in speaking of several distinct forms of them, to employ the term *Clionolithes*.

The straight clavate tubes of *Clionolithes priscus* (McCoy) usually originate at the edge of a dead shell and expand gently inward; probably the sponge nested at the club-shaped extremity of the hole, drawing the water currents in to itself. It is not always the case that the shell was dead before the work of these borers began. There are several illustrations given here to show that a brachiopod or pelecypod may have been attacked by these sponges at any growth stage and that after the attack had begun the growth of the shell continued. There is a curious simultaneousness in the attacks of these pseudoparasites—all started in at once and frequently one such attack is not followed by others [see pl. 8, fig. 2, 4]. This form, *C. priscus*, was quite common in the late Siluric and very abundant throughout the Devonian.

Clionolithes radicans designates a quite different expression of this boring habit. Here the tubes radiate and branch outward from a center, giving a decided rootlike expression to the resultant very complicated combination of tubes. These branching tubes often unite, fuse or anastomose producing a somewhat irregularly reticulated expression. This sponge particularly infested the living and dead shells of the brachiopods, finding entrance less often at the margin than through the pores on the surface of the shell. The complex of tubules is small in comparison with those of *C. priscus* and it is not unusual to find both of these forms infesting the same shell. This boring sponge, so far as my observation extends, is restricted to the Devonian.

Clionolithes reptans has threadlike vermiform tubes which wander loosely and at random through the shell substance of both brachiopods and pelecypods.

Clionolithes palmatus, a singular form assuming broad sparsely branched palmate hollow fronds and found only in the pelecypods and gastropods of the Portage group (Upper Devonian).

Among these boring bodies is another, which judging only from the form of its tubes must have been very unlike the rest. I have observed it only in the brachiopods of the Coblentzian sandstone and in order to express its notable difference from the other borings mentioned shall designate it as *Caulostrepis taeniola*. In these the borers began at the edge of the shell and the casts of their borings are long, narrow tapelike tongues with an elevated edge all the way around. This corded edge is a continuous tube while the area between is a narrow flat space connecting the tubes of the loop. I hesitate to assign this curious form to the sponges; it has in miniature a resemblance to some of the worm casts found on the surface of old rocks, but the evident open connexion between the tubes of the loop makes it difficult to allot to this boring its probable maker.

Boring pelecypods were not unknown in the early Paleozoic. Instances are rare indeed but a very striking example is the small Modiomorphalike shell *Corallidomus concentricus* described by Whitfield from the Cincinnati shales of Ohio [see Geol. Ohio. 1893. 7: 493, pl. 13]. The figure given by this author shows a colony of the coral *Labechia ohioensis* Nicholson perforated by scores of burrows in some of which the shell itself is found. Such occurrences have been freely described in Mesozoic faunas and boring insects in the woods of the Tertiary.

EXPLANATION OF PLATES

PLATE I

- 1 Part of the weathered surface of a *Stromatopora* from the Cobleskill limestone, Schoharie, N. Y., showing the openings of the worm tubes *Gitonia siphon*
- 2 A section of the same colony permeated with such tubes
- 3 A colony of *Favosites sphericus* Hall from the New Scotland beds (Helderbergian) with similar tubes
- 4 A head of the trilobite *Dalmanites* overgrown with a colony of *Monticulipora* in which is embedded a series of *Gitonia siphon*. Onondaga limestone, Becraft mountain, N. Y.
- 5 Sections of spiral tubes (*Streptindytes conconatus*) in a colony of *Stromatopora*. The apparent difference in direction of volution in these is due entirely to the different depth and angle at which the tubes are cut. From the Cobleskill limestone (Upper Siluric) Schoharie.
x 2
- 6 An enlarged restoration of the characters of these worm tubes. x 5
- 7 *Streptindytes acervulariae* Calvin: two tubes in a colony of *Acervularia davidsoni* E. and H. x 1.5. From the Middle Devonian of Roberts Ferry, Iowa

PLATE 1.

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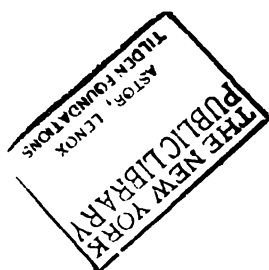


PLATE 2 .

- 1 A calyx of *Zaphrentis* with a number of tube openings of *Gitonia corallophila*
 - 2 Tubes of the same character opening outward through the lateral walls of *Zaphrentis*; much enlarged
 - 3 A *Zaphrentis* with tube openings at the base
 - 4 A *Cystiphyllum* with short tubes opening outward through the thecal walls
 - 5, 6 A *Zaphrentis* from two points of view to show the course of a tube of *Gitonia corallophila* with both ends opening outward in the calyx
- All these specimens are from the Onondaga limestone (Lower Devonian).
- 7 *Caunopora* — a schematic section showing the *Syringopora*- or *Aulopora*-like tubes overgrown by the *Stromatopora* substance; coral on coral
 - 8-11 Enlarged figures of *Spirorbis angulata* Hall, a worm tube from the Hamilton group of New York. These specimens are silica replacements etched from limestone (Menteth limestone), and show the tendency of the tube to unwind in a lax spiral as soon as fixation is firmly established.

PLATE 2.

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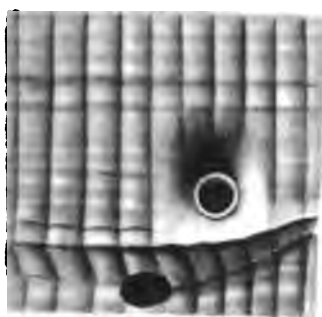
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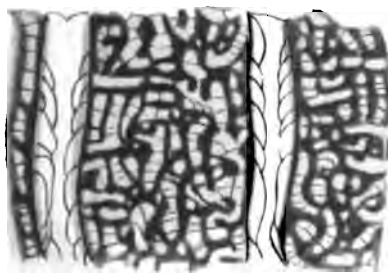
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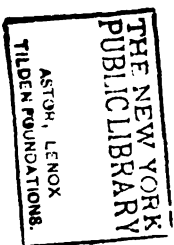


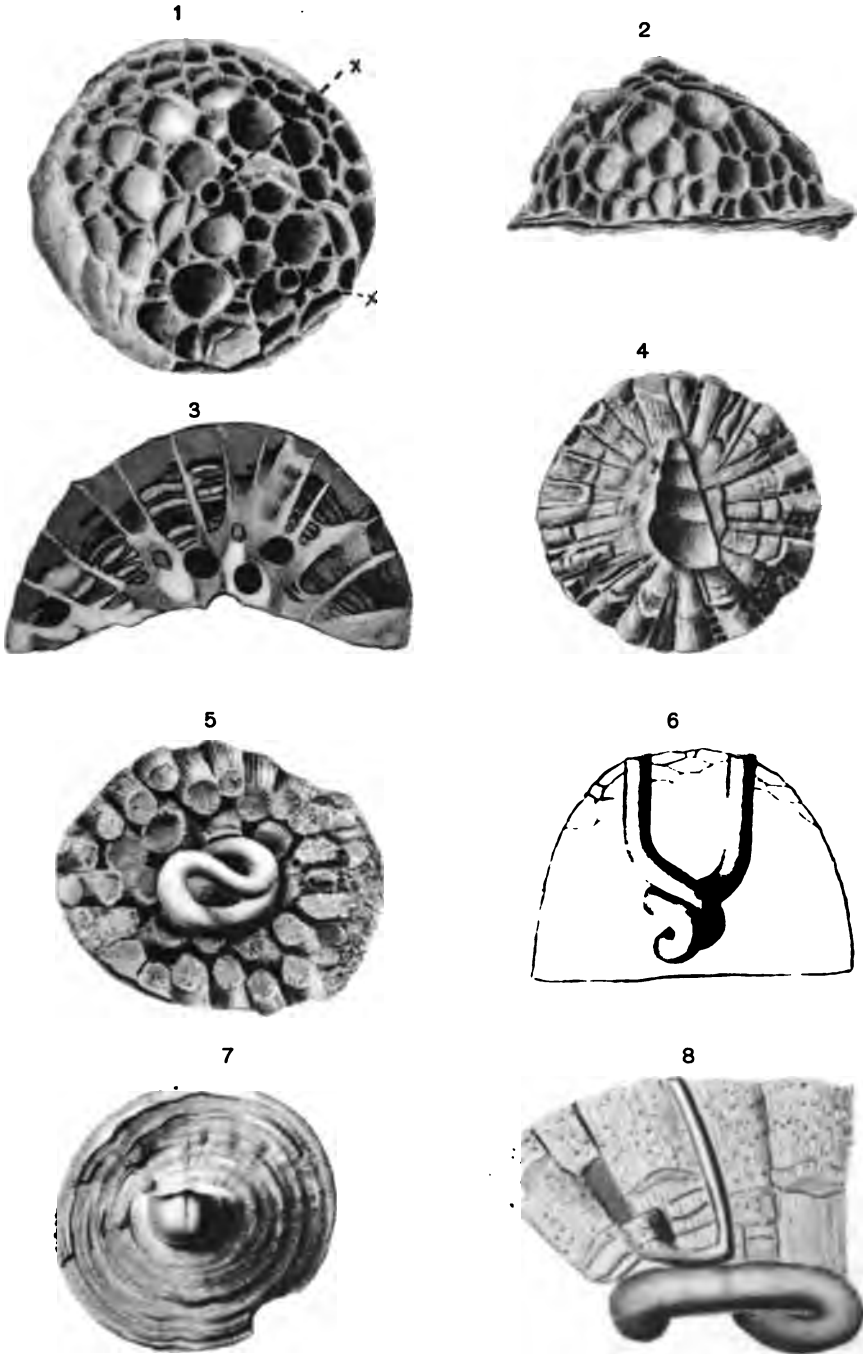


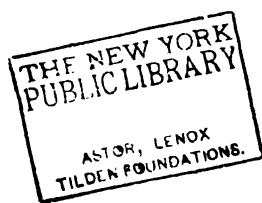
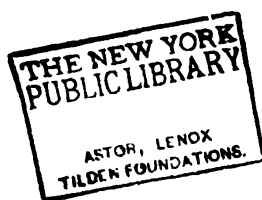
PLATE 3

A series of drawings to illustrate the commensalism of *Pleurodictyum* and the worm *Hicetes innexus*

- 1, 2 Top and side views of a corallum of *Pleurodictyum styloporum* Eaton from the Hamilton shales of New York. The worm tubes are clearly seen at x-x on the surface of the colony.
- 3 Vertical section of a corallum showing sections of the convoluted tube near its base
- 4 The under side of a corallum with impression of the gastropod *Loxonema hamiltoniae* to which it is attached
- 5 An etching which has removed the base of the coral and shows the initial convolutions of the worm tube
- 6 The form of the entire tube, drawn from an actual specimen
- 7 The basal surface of *Pleurodictyum problematicum* attached to the brachiopod *Chonetes sarcinulatus* Goldfuss. This specimen is from the Coblenzian at Stadtfeld.
- 8 An etching of the basal part of *P. styloporum* showing the chief worm and a wormlike extension which appears to arise from the base of a polypite and turn into an upward course between the cells

PLATE 3





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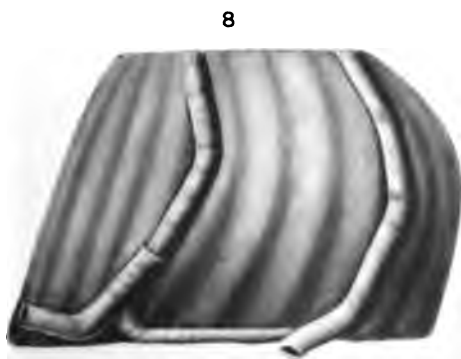
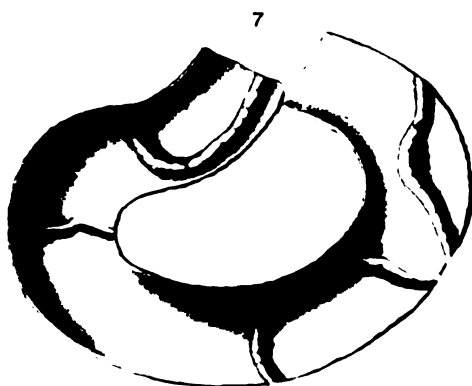
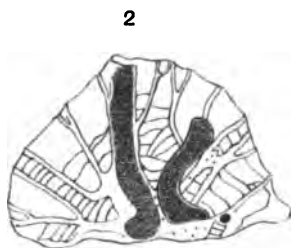
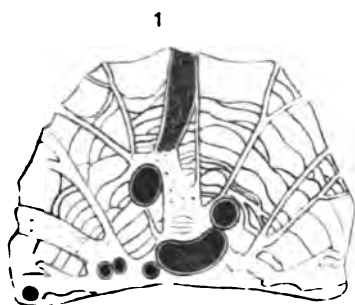
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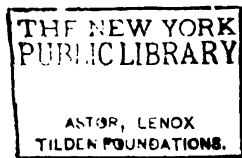
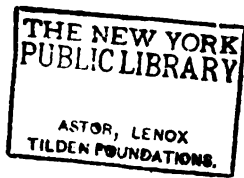
PLATE 4

Continuation of the illustration of *Pleurodictyum* and *Hicetes*, etc.

- 1, 2 Sections of *P. styloporum* showing not only the large worm but the smaller ones in the thickened base of the coral
- 3 An etching of *P. styloporum* showing actual attachment of the worm tube *Hicetes* to the surface of the gastropod *Loxonema*
- 4 The tube *Hicetes* penetrating one polyp cell and passing thence into another
- 5 The small sponge found in the tube of the large worm *Hicetes*
- 6 *Chonetes sarcinulatus* Goldfuss, the brachiopod to which *P. problematicum* usually is attached.
(After F. Roemer)
- 7 The greatly enlarged interior surface of the worm tube *Hicetes* with slender serpulid worm tubes attached
- 8 The enlarged surface of part of a *Loxonema*, covered with small serpulids. This specimen of *Loxonema* had served as base of attachment for *P. styloporum*.
- 9 *Loxonema hamiltoniae* Hall

PLATE 4.





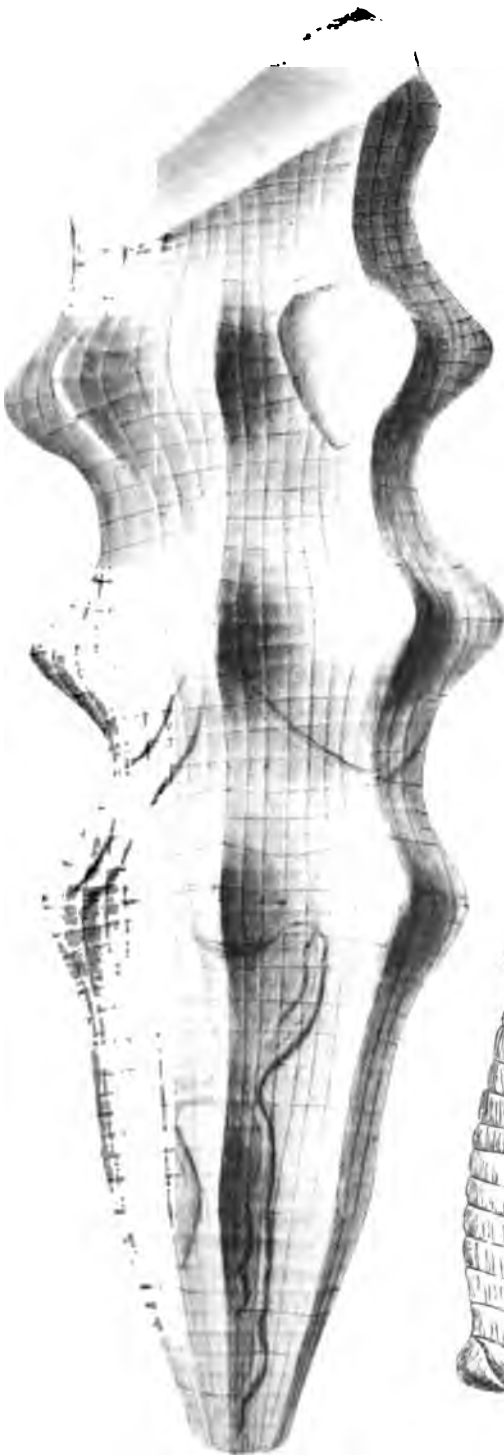
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PLATE 5

- 1 *Hydnoceras tuberosum* Conrad var. *glossema* H. & C. A silicious hexactinellid sponge with markings of worm tubes on the inner side of the reticulum. From the Chemung group (Upper Devonian) of southwestern New York
- 2 Another silicious sponge, *Prismodictya telum* H. & C. with similar worm tubes also from the Chemung group of New York
- 3 The barnacle *Lepidocoleus jamesi* of the Lower Silurian (Cincinnatian group) showing the unattached condition of the animal whose segmentation may be regarded as represented by the paired valves which meet at the edge allowing room for the protrusion of the appendages
- 4, 5 *Palaeocreusia devonica* Clarke, a barnacle buried in a colony of *Favosites hemisphericus* partly by burrowing and partly by overgrowth of the coral. From the Onondaga limestone, Leroy, N. Y.

PLATE 5

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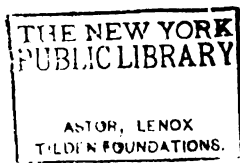
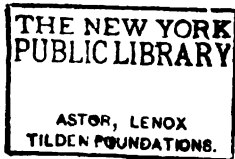


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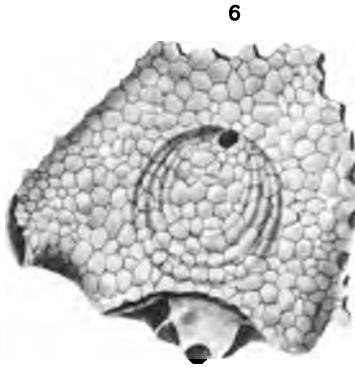
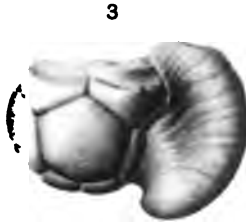
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1912

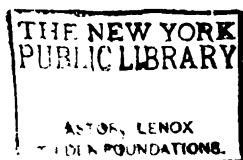
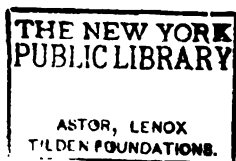
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ROYAL ANTHROPOLOGICAL INSTITUTE
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VOLUME 42
PART 2
1912

PLATE 6

- 1 *Caryocrinites ornatus* Say, a cystid having a small gastropod (*Strophostylus*) attached and covering the apertures of the summit. From the Upper Siluric (Rochester) shale of western New York
- 2 *Glyptocrinus (decadactylus)* Hall) with a holostomatous gastropod, *Cyclonema bilix*, inclosed within the arms in an attitude of feeding at or near the anal aperture of the crinoid. From the Cincinnati shale
- 3, 4 *Cromyocrinus simplex* with attached *Platyceras* of relatively large size, its anterior portion covering the anal aperture of the crinoid while the rest of the lip of the snail extends over the entire height of the calyx. Carbonic limestone, Moscow, Russia
- 5 *Platyceras* enveloping the dome of *Arthracantha punctobrachiata* Williams [after Hinde, Ann. & Mag. Nat. Hist. 1885]. From the Hamilton group
- 6 A part of the tegmen of *Strotocrinus regalis* Hall showing the successive growth marks made by an attached *Platyceras*, always keeping its anterior extremity over the anal aperture of the crinoid [after Keyes, Acad. Nat. Sci. Phila. Proc. 1890. pl. 2, fig. 7]. From the Carbonic (Mississippian) of Crawfordsville, Ind.
- 7 *Platyceras infundibulum* Meek & Worthen attached to the anal surface of *Platycrinus hemisphericus* M. & W. [after Keyes *ut. cit.* fig. 10]
- 8 *Actinocrinus multiramosus* Wachsmuth & Springer. The calyx with a starfish (*Onychaster*) fastened to the anal tube [after Wachsmuth & Springer *ut. cit.* pl. 55, fig. 3]

PLATE 6





1. *Staphylococcus aureus* (1000)
 2. *Staphylococcus aureus* (1000)
 3. *Staphylococcus aureus* (1000)
 4. *Staphylococcus aureus* (1000)
 5. *Staphylococcus aureus* (1000)
 6. *Staphylococcus aureus* (1000)
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 9. *Staphylococcus aureus* (1000)
 10. *Staphylococcus aureus* (1000)

PLATE 7

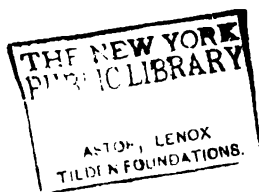
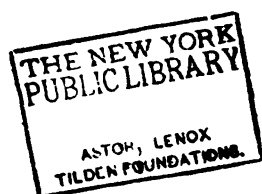
- 1, 2 Two specimens of *Barycrinus hoveyi* Hall with the starfish *Onychaster flexilis* intertwined within the arms. (Mississippian) Carbonic. Crawfordsville, Ind. From the collection of F. Braun

PLATE 7



2





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PLATE 8

- 1 *Clionolithes* (*Vioa*) *priscus* McCoy, cast of borings in a shell of *Pterinea demissa* (Conrad) McCoy [after McCoy, Brit. Paleoz. Foss. pl. 1B, fig. 1, 1a]
- 2 The same. A series of clavate tubes in the shell substance of *Leptocoelia flabellites* (Conrad) all starting from the margin of the valve at a definite period of growth in the shell. x 2. Oriskany sandstone, Highland Mills, N. Y.
- 3 The same in a valve of *Spirifer* from the Chemung group near Sideling hill, Maryland. x 3
- 4 The same. A valve of *Aviculopecten* from the Chemung group (Upper Devonian) of Allegany county, N. Y. with a series of borings all beginning at a definite growth stage of the shell beyond which shell growth has continued, indicating that the mollusk was alive when the borings were begun and continued to live while they were making
- 5 A valve of *Spirifer granulosus* from the Hamilton shales of New York, with several such borings
- 6 A tube cast in the valve of the brachiopod *Leptostrophia perplana* (Conrad). The sponge started to bore at the thickened cardinal process of the dorsal valve and on account of the thinness of the valve was compelled to make its tube broader than high. At the inner end the tube spreads out and shows a tendency to divide. x 3. From the Hamilton shales of New York
- 7 Another example of a flattened tube cast on a thin shelled pelecypod of the Hamilton group, N. Y.
- 8 Clavate borings in a valve of *Leptostrophia oriskania*, Oriskany limestone, Becraft mountain, N. Y., x 3

PLATE 8.

1



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3



5



4



6

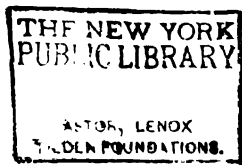
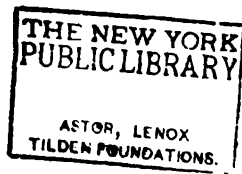


7



8





1994

1995

1996

PLATE 9

- 1 *Clionolithes priscus* (McCoy). A specimen of *Leptostrophia magnifica* Hall, from the Grande Grève limestone (Lower Devonic) of Gaspé with several straight clavate tubes extending in from the margin of the shell. Where the shell substance has disappeared at the right of the specimen are seen numerous examples of the branched boring, *Clionolithes radicans*.
 - 2 *Clionolithes radicans*. An etched specimen of an old-shell of the brachiopod *Dalmanella superstes* H. & C. of the Chemung shales of New York with a multitude of irregularly branching borings riddling the shell and apparently starting inward from the shell margin.
- x 8

PLATE 9

1



2



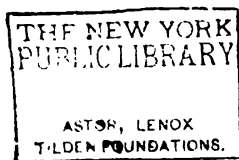
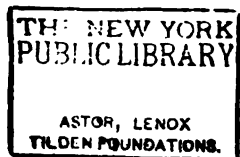




PLATE 10

A greatly enlarged view of an etched specimen of the brachiopod *Atrypa reticularis* Linné, whose outer surface has been overgrown with a monticuliporoid coral and whose shell substance was perforated with branching clusters of the tubes of *Clionolithes radicans*. From the Onondaga limestone, Becraft mountain, N. Y.

PLATE 10





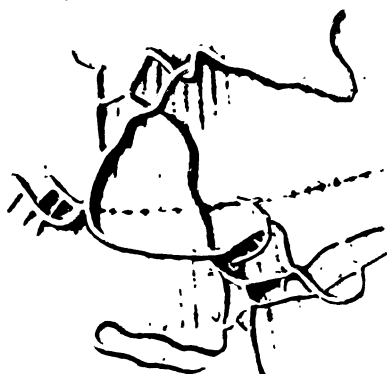


PLATE 11

- 1 *Clionolithes radicans*, a single cluster of tube casts, x5 in the substance of the shell of *Atrypa reticularis* from the Chemung sandstone of Mansfield, Pa.
- 2 The same. A silicified replacement of a tube cluster within the shell substance of *Leptostrophia magnifica* Hall, standing in relief on the surface of the valve. From an enlarged photograph, which also shows the casts of the small tubules constituting a proper part of the structure of this shell and through one of which it is probable that the sponge entered. From the Grande Grève limestone (Lower Devonic) Gaspé
- 3 *Clinolithes reptans*; sparse, diffuse tubules in the substance of a shell of *Leptostrophia oriskania*, Oriskany limestone, Becraft mountain, N. Y. Greatly enlarged

PLATE 11.

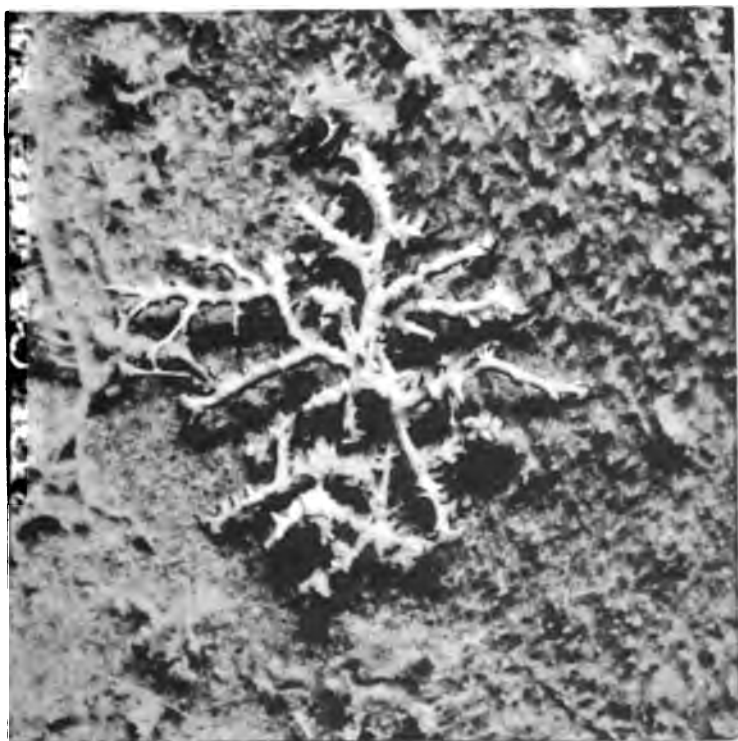
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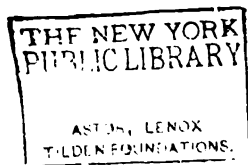
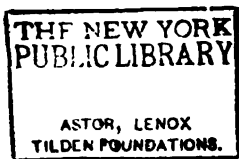


1



2





1000

1000

1000

1000

1000

PLATE 12

- 1 *Clionolithes palmatus*. A valve of the pelecypod *Loxopteria dispar* Sandberger, from the Portage beds (Upper Devonian) of Correll's point, N. Y. in the substance of which this cluster of frond-shaped cavities lies. x 2
- 2 The same. A somewhat more diffuse cluster in the shell substance of *Loxonema danai* Clarke from the same formation and locality. x 5
- 3 *Caulostrepsis taeniola*. *Stropheodonta* cf. *gigas* McCoy from the Seigener schichten (Coblentzian) of Seifen. The margin of the brachiopod has been entered on all sides simultaneously by these borers forming loop-shaped tubes which are joined by a thin median cavity. Together with these are simple tube casts of *Clionolithes priscus*. I owe this specimen to the kindness of Prof. E. Kayser.
- 4 The same on *Stropheodonta protaeniolata* Maurer, same locality [after Maurer]
- 5, 6, 7 Large circular perforations in the valves of brachiopods, probably made by the radula of predatory gastropods. In figure 5 the brachiopod is *Spirifer medialis* Hall from the Hamilton shales of New York; figure 6, *Meristella* from the Oriskany limestone of Glenerie, N. Y.; and figure 7 a small *Spirifer granulosus* Conrad from the Hamilton rocks. In 5 and 7 the hole is on the dorsal valve and has precisely the same position with reference to the shell and the animal within which the gastropod was doubtless seeking. The hole, figure 6, has the same position on the ventral valve of *Meristella*. It is interesting to observe that the *Spirifer* in figure 5 and the *Meristella* in figure 6 succeeded in forestalling the purposes of the enemy by secreting a false floor beneath the hole after it had perforated the shell. *Spirifer*, figure 7 may have fallen a victim to the attack as the hole is not sealed. These are instructive illustrations of the early acquisition of this perforating mode of attack by the gastropods.

PLATE 12.

1



2



3



5



4



6



7



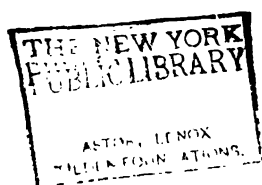
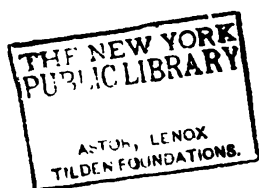


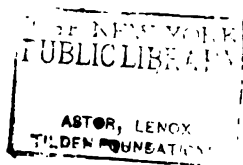
PLATE 13

A colony of the coral *Favosites niagarensis* Hall which has partially overgrown a small plantation of the cyathophylloid coral *Amplexus*, but not to such extent as to interfere with the calyces of the latter

From the Niagaran formation near Monticello, Iowa. The print has been kindly loaned by Dr Samuel Calvin.

PLATE 13





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MUSEUM PUBLICATIONS

v. 5 pt5 Mollusca. 4+271p. 40pl. pt6 Crustacea. 70p. 13pl. 1843-44.
Hand-colored plates; pt5-6 bound together.

DIVISION 2 BOTANY. Torrey, John. Flora of the State of New York; comprising full descriptions of all the indigenous and naturalized plants hitherto discovered in the State, with remarks on their economical and medical properties. 2v. il. pl. sq. Q. Albany 1843. *Out of print.*

v. 1 Flora of the State of New York. 12+484p. 72pl. 1843.
300 copies with hand-colored plates.

v. 2 Flora of the State of New York. 572p. 89pl. 1843.
300 copies with hand-colored plates.

DIVISION 3 MINERALOGY. Beck, Lewis C. Mineralogy of New York; comprising detailed descriptions of the minerals hitherto found in the State of New York, and notices of their uses in the arts and agriculture. il. pl. sq. Q. Albany 1842. *Out of print.*

v. 1 pt1 Economical Mineralogy. pt2 Descriptive Mineralogy. 24+536p. 1842.

8 plates additional to those printed as part of the text.

DIVISION 4 GEOLOGY. Mather, W. W.; Emmons, Ebenezer; Vanuxem, Lardner & Hall, James. Geology of New York. 4v. il. pl. sq. Q. Albany 1842-43. *Out of print.*

v. 1 pt1 Mather, W. W. First Geological District. 37+653p. 46pl. 1843.

v. 2 pt2 Emmons, Ebenezer. Second Geological District. 10+437p. 17pl. 1842.

v. 3 pt3 Vanuxem, Lardner. Third Geological District. 306p. 1842.

v. 4 pt4 Hall, James. Fourth Geological District. 22+683p. 19pl. map. 1843.

DIVISION 5 AGRICULTURE. Emmons, Ebenezer. Agriculture of New York; comprising an account of the classification, composition and distribution of the soils and rocks and the natural waters of the different geological formations, together with a condensed view of the meteorology and agricultural productions of the State. 5v. il. pl. sq. Q. Albany 1846-54. *Out of print.*

v. 1 Soils of the State, their Composition and Distribution. 11+371p. 21pl. 1846.

v. 2 Analysis of Soils, Plants, Cereals, etc. 8+343+46p. 42pl. 1849.
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v. 3 Fruits, etc. 8+340p. 1851.

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v. 5 Insects Injurious to Agriculture. 8+272p. 50pl. 1854.
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v. 2 Organic Remains of Lower Middle Division of the New York System. 8+362p. 104pl. 1852. *Out of print.*

v. 3 Organic Remains of the Lower Helderberg Group and the Oriskany Sandstone. pt1, text. 12+532p. 1859. [\$3.50]
—pt2. 143pl. 1861. [\$2.50]

v. 4 Fossil Brachiopoda of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 11+1+428p. 69pl. 1867. \$2.50.

v. 5 pt1 Lamellibranchiata 1. Monomyaria of the Upper Helderberg, Hamilton and Chemung Groups. 18+268p. 45pl. 1884. \$2.50.

—Lamellibranchiata 2. Dimyaria of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 62+293p. 51pl. 1885. \$2.50.

—pt2 Gasteropoda, Pteropoda and Cephalopoda of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 2v. 1879. v. 1, text. 15+492p. v. 2, 120pl. \$2.50 for 2 v.

—& Simpson, George B. v. 6 Corals and Bryozoa of the Lower and Upper Helderberg and Hamilton Groups. 24+298p. 67pl. 1887. \$2.50.

—& Clarke, John M. v. 7 Trilobites and other Crustacea of the Oriskany, Upper Helderberg, Hamilton, Portage, Chemung and Catskill Groups. 64+236p. 46pl. 1888. Cont. supplement to v. 5, pt2. Pteropoda Cephalopoda and Annelida. 42p. 18pl. 1888 \$2.50.

NEW YORK STATE EDUCATION DEPARTMENT

- & Clarke, John M. v. 8 pt. Introduction to the Study of the Genera of the Paleozoic Brachiopoda. 16+367p. 44pl. 1892. \$2.50.
 — & Clarke, John M. v. 8 pts. Paleozoic Brachiopoda. 16+394p. 64pl. 1894. \$2.50.

Catalogue of the Cabinet of Natural History of the State of New York and of the Historical and Antiquarian Collection annexed thereto. 242p. O 1853.

Handbooks 1893-date.

In quantities, 1 cent for each 16 pages or less. Single copies postpaid as below.

New York State Museum. 52p. il. 4c.

Outlines history and work of the museum with list of staff 1902.

Paleontology. 12p. 2c.

Brief outline of State Museum work in paleontology under heads: Definition; Relation to biology; Relation to stratigraphy; History of paleontology in New York.

Guide to Excursions in the Fossiliferous Rocks of New York. 124p. 8c.

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Entomology. 16p. 2c.

Economic Geology. 44p. 4c.

Insecticides and Fungicides. 20p. 3c.

Classification of New York Series of Geologic Formations. 32p. 3c.

Geologic maps. Merrill, F. J. H. Economic and Geologic Map of the State of New York; issued as part of Museum bulletin 15 and 48th Museum Report, v. 1. 50x67 cm. 1894. Scale 14 miles to 1 inch. 15c.

— Map of the State of New York Showing the Location of Quarries of Stone Used for Building and Road Metal. Mus. bul. 17. 1897. 10c.

— Map of the State of New York Showing the Distribution of the Rocks Most Useful for Road Metal. Mus. bul. 17. 1897. 5c.

— Geologic Map of New York. 1901. Scale 5 miles to 1 inch. In atlas form \$3; mounted on rollers \$5. Lower Hudson sheet 60c.

The lower Hudson sheet, geologically colored, comprises Rockland, Orange, Dutchess, Putnam, Westchester, New York, Richmond, Kings, Queens and Nassau counties, and parts of Sullivan, Ulster and Suffolk counties; also northeastern New Jersey and part of western Connecticut.

— Map of New York Showing the Surface Configuration and Water Sheds. 1901. Scale 12 miles to 1 inch. 15c.

— Map of the State of New York Showing the Location of its Economic Deposits. 1904. Scale 12 miles to 1 inch. 15c.

Geologic maps on the United States Geological Survey topographic base; scale 1 in. = 1 m. Those marked with an asterisk have also been published separately.

*Albany county. Mus. rep't 49. v. 2. 1898. 50c.

Area around Lake Placid. Mus. bul. 21. 1898.

Vicinity of Frankfort Hill [parts of Herkimer and Oneida counties]. Mus. rep't 51, v. 1. 1899.

Rockland county. State geol. rep't 18. 1899.

Amsterdam quadrangle. Mus. bul. 34. 1900.

*Parts of Albany and Rensselaer counties. Mus. bul. 42. 1901. 10c.

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*Rochester and Ontario Beach quadrangles. Mus. bul. 114. 20c.

*Long Lake quadrangles. Mus. bul. 115. 10c.

*Nunda-Portage quadrangles. Mus. bul. 118. 20c.

Education Department Bulletin

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NO. 429

ALBANY, N. Y.

AUGUST 15, 1908

New York State Museum

JOHN M. CLARKE, Director

CHARLES H. PECK, State Botanist

Museum bulletin 122

New York State REPORT OF THE STATE BOTANIST 1907

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ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1908

STATE OF NEW YORK
EDUCATION DEPARTMENT

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With years when terms expire

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*New York State Education Department
Science Division, February 3, 1908*

*Hon. Andrew S. Draper LL.D.
Commissioner of Education*

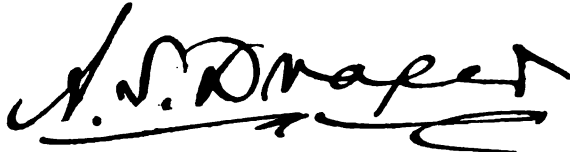
MY DEAR SIR: I communicate herewith, for publication as a bulletin of the State Museum, the annual report of the State Botanist for the fiscal year ending September 30, 1907.

Very respectfully

JOHN M. CLARKE
Director

*State of New York
Education Department
COMMISSIONER'S ROOM*

Approved for publication this 3d day of February 1908

A large, stylized handwritten signature in black ink, reading "A. S. Draper". The signature is written in a cursive style with a prominent horizontal line at the bottom.

Commissioner of Education

Education Department Bulletin

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NO. 429

ALBANY, N. Y.

AUGUST 15, 1908

New York State Museum

JOHN M. CLARKE, Director

Museum bulletin 122

REPORT OF THE STATE BOTANIST 1907

Dr John M. Clarke, Director of the State Museum:

I have the honor of submitting to you my report of work done in the botanical department of the State Museum during the year 1907.

Specimens of plants have been collected in the counties of Albany, Greene, Herkimer, Jefferson, Oneida, Onondaga, Putnam, Rensselaer, Saratoga and Steuben.

Specimens of plants have been contributed by correspondents and others which were collected in the counties of Albany, Essex, Franklin, Herkimer, Monroe, New York, Onondaga, Ontario, Orleans, Richmond, Seneca, Steuben, Tompkins, Ulster, Warren and Washington.

The number of species of which specimens have been added to the herbarium is 203. Of these, 82 are new to the herbarium, 121 are not. Of those new to the herbarium, 45 are new species, 38 being species of *Crataegus*, 7 of fungi. A list of the names of the added species is given under the caption, "Species added to the herbarium."

The number of those who have contributed specimens is 72. This includes those who have contributed specimens of extralimital species and also those who have sent specimens for identification merely, if the specimens were rare or if for any other reason they were considered desirable or worthy of preservation. A list of the names of contributors and of their respective contributions is given under the heading "Contributors and their contributions." Under the heading, "Species not before reported" may be found the

names of species added to our flora, with localities, remarks and descriptions of new species, except in species of the genus *Crataegus*. Localities and descriptions of new species of these are given in the three papers on this subject in another part of the report. These papers have been prepared and kindly contributed by the eminent and expert dendrologist, Prof. C. S. Sargent. Unfortunately many of these species are not represented in our collection by specimens and can not yet be counted as additions to the herbarium. The whole number of species of this genus added to our flora is 88, making the number of New York species of this genus now known 185. But specimens of nearly all the new species credited to Coopers Plains and vicinity have been collected by the writer, and with the specimens contributed by Mr G. D. Cornell, these species are with one or two exceptions all now represented in the herbarium.

The past season, in its relation to the mushroom crop has been very similar to that of 1906. Early in the season there were sufficient rains but cool weather. These conditions were followed by a long period of dry weather unfavorable to the mushroom growth, and crowding it into a short period late in the season. The number of species whose edible qualities have been tried and approved is 8. These have been illustrated on five plates and described as in the plan followed in the preceding report. The whole number of New York edible species now illustrated is 191. The number of plates illustrating them and the poisonous and unwholesome species is 114.

A revision has been made of the New York species of the somewhat difficult genus *Pholiota*. The number of species now recognized as belonging to it is 32. Revised descriptions of these have been written and a key prepared to facilitate the tracing of the species to their respective descriptions.

The number of those seeking information from the botanical department concerning the identity of plants or their character is 117. The number of identifications made is 891.

My assistant, Mr Stewart H. Burnham, has disinfected the collections of 1906 which needed such treatment, labeled and arranged them in their proper places, assisted in conducting the correspondence of the office, in the identification of specimens of inquirers and in giving them the desired information. He has prepared a typewritten catalogue of the species of fungi described by the State Botanist, and made a typewritten copy of the present report.

Respectfully submitted

CHARLES H. PECK

State Botanist

Albany, December 31, 1907

SPECIES ADDED TO THE HERBARIUM

New to the herbarium

- | | |
|-----------------------------------|--------------------------------------|
| Ajuga reptans L. | Crataegus rubrolutea S. |
| Biatora prasina Fr. | C. singularis S. |
| Biatorella simplex (Dav.) B. & R. | C. spatifolia S. |
| Boletus niveus Fr. | C. spinifera S. |
| Centaurea solstitialis L. | C. spissa S. |
| Cetraria glauca (L.) Ach. | C. steubenensis S. |
| Chaetomium sphaerospermum C. & E. | C. structilis Ashe |
| Cladonia bacillaris (Del.) Nyl. | C. suavis S. |
| Clitocybe subcyathiformis Pk. | C. suborbiculata S. |
| Clitopilus subplanus Pk. | C. uncta S. |
| Crataegus acerba S. | C. verrucalis Pk. |
| C. affinis S. | Cronartium ribicola Dietr. |
| C. amoena S. | Diaporthe parasitica Murr. |
| C. anomala S. | Flammula pulchrifolia Pk. |
| C. barryana S. | Galium erectum Huds. |
| C. bella S. | Hygrophorus coloratus Pk. |
| C. claytoniana S. | H. lacmus Fr. |
| C. comans S. | Hypocrea polyporoidea B. & C. |
| C. cornellii S. | Lactarius minusculus Burl. |
| C. desueta S. | Leaia piperata Banker |
| C. dewingii S. | Lecidea platycarpa Ach. |
| C. dissociabilis S. | Lophiotrema semiliberum (Desm.) |
| C. diversa S. | Lotus corniculatus L. |
| C. floridula S. | Metzgeria conjuncta Lindb. |
| C. frutescens S. | Monilia crataegi Diedicke |
| C. fucata S. | Myxosporium necans Pk. |
| C. gracilis S. | Nolanea suaveolens Pk. |
| C. ignea S. | Parmelia cetrata Ach. |
| C. inopinata S. | P. perforata (Jacq.) Ach. |
| C. insignata S. | Pholiota duroides Pk. |
| C. inusitula S. | Physcia hypoleuca (Muhl.) Tuck. |
| C. limosa S. | Polyporus spraguei B. & C. |
| C. macrocalyx S. | Polystictus montagnei Fr. |
| C. nescia S. | Rinodina oreina (Ach.) Mass. |
| C. numerosa S. | Russula aeruginea Fr. |
| C. ovatifolia S. | Sphaeropsis lyndonvillae Sacc. |
| C. pellecta S. | S. persicae E. & B. |
| C. plana S. | Stereocaulon coralloides Fr. |
| C. ramosa S. | Stropharia bilamellata Pk. |
| C. recta S. | Trentepohlia umbrina (Kütz.) Born. |
| C. repulsans S. | Tubercularia davisiana Sacc. & Trav. |
| | Viola vagula Greene |

Not new to the herbarium

- Aecidium clematidis* DC.
Ae. grossulariae (Gmel.) Schum.
Agaricus arvensis Schaeff.
Alsine longifolia (Muhl.) Britton
Amanita caesarea Scop.
A. formosa G. & R.
A. phalloides Fr.
A. rubescens Fr.
Amanitopsis farinosa (Schw.)
A. vaginata (Bull.) Rose
Aronia nigra (Willd.) Britton
Aster divaricatus L.
A. panic. bellidiflorus (Willd.)
Blitum capitatum L.
Boletus albocarneus Pk.
B. castaneus Bull.
B. chromapes Frost
B. clintonianus Pk.
B. elbensis Pk.
B. nebulosus Pk.
B. ravenelii B. & C.
B. subaureus Pk.
B. subtomentosus L.
Calvatia elata (Mass.) Morg.
Cantharellus cibarius Fr.
C. cinnabarinus Schw.
C. floccosus Schw.
C. minor Pk.
Carya amara Nutt.
C. glabra odorata Sarg.
Castanea dentata Borkh.
Chrysanthemum leucanthemum L.
Clitocybe amethystina (Bolt.)
C. candicans Fr.
C. laccata (Scop.) Fr.
Clitopilus caespitosus Pk.
Collybia acervata Fr.
C. dryophila (Bull.) Fr.
C. lacunosa Pk.
C. platyphylla Fr.
Conringia orientalis (L.) Dum.
Cortinarius torvus Fr.
Crataegus bissellii S.
C. uniflora Muench.
Cypripedium arietinum R. Br.
Cystopus amaranthi Berk.
Dasystema virginica (L.) Britton
Deconica bullacea Bull.
Dryopteris goldieana (Hook.) Gray
Eleocharis ovata (Roth) R. & S.
Erysimum cheiranthoides L.
Erysiphe polygoni DC.
Euphorbia polygonifolia L.
Flammula lubrica Fr.
Fraxinus lanceolata Borkh.
F. pennsylvanica Marsh.
Fuligo ovata (Schaeff.) Macb.
Fusisporium destruens Pk.
Galium mollugo L.
Habenaria blephariglottis (Willd.)
H. ciliaris (L.) R. Br.
Helotium citrinum (Hedw.) Fr.
Helvella infula Schaeff.
Hydnum fennicum Karst.
H. septentrionale Fr.
Hygrophorus borealis Pk.
H. ceraceus Fr.
H. coccineus (Schaeff.)
H. marginatus Pk.
H. pratensis (Pers.) Fr.
Hypholoma candolleianum Fr.
H. capnoides Fr.
H. incertum Pk.
H. subaquilum Banning
H. sublateralitium (Schaeff.)
Lactarius camphoratus Fr.
L. insulsus Fr.
L. oculatus (Pk.) Burl.
L. subdulcis Fr.
L. varius Pk.
Lentinus spretus Pk.
Lenzites sepiaria Fr.
Lepiota acerina Pk.
Lycoperdon gemmatum Batsch
L. glabellum Pk.
L. subincarnatum Pk.
Marasmius glabellus Pk.
M. minutus Pk.
M. subnudus (Ellis) Pk.
Mycena rosella Fr.
Panus torulosus Fr.
Paxillus involutus Batsch
Phlebia radiata Fr.
Pholiota aggericola Pk.

<i>Pholiota caperata</i> Fr.	<i>Russula decolorans</i> Fr.
P. <i>discolor</i> Pk.	R. <i>emetica</i> Fr.
P. <i>praecox</i> Pers.	R. <i>fallax</i> Fr.
<i>Polyporus adustus</i> Willd.	R. <i>obscura</i> Rom.
P. <i>betulinus</i> Fr.	R. <i>ochrophylla</i> Pk.
P. <i>caesius</i> Fr.	R. <i>pectinatoides</i> Pk.
P. <i>cuticularis</i> (Bull.) Fr.	R. <i>squalida</i> Pk.
<i>Polystictus bififormis</i> Klotz.	R. <i>uncialis</i> Pk.
P. <i>pergamenus</i> Fr.	R. <i>variata</i> Banning
<i>Psilocybe conissans</i> Pk.	R. <i>virescens</i> Schaeff.
<i>Puccinia andropogonis</i> Schw.	<i>Salix serissima</i> (Bail.) Fern.
P. <i>coronata</i> Cd.	<i>Thelephora palmata</i> (Scop.) Fr.
<i>Russula crustosa</i> Pk.	<i>Tricholoma personatum</i> Fr.
T.	<i>vaccinum</i> Pers.

CONTRIBUTORS AND THEIR CONTRIBUTIONS

Miss H. C. Anderson, Lambertville, N. J.

<i>Russula vesca</i> Fr.	<i>Sclerotinia tuberosa</i> (Hedw.) Fckl.
--------------------------	---

Miss G. S. Burlingham, Mexico

<i>Lactarius aspidioides</i> Burl.	<i>Lactarius circellatus</i> (Batt.) Fr.
L. <i>bensleyae</i> Burl.	<i>Peckiella hymenioides</i> Pk.

Mrs E. B. Blackford, Boston, Mass.

<i>Boletus gracilis laevipes</i> Pk.	<i>Omphalia serotina</i> Pk.
--------------------------------------	------------------------------

Miss M. C. Burns, Middleville

Cantharellus floccosus Schw.

Mrs G. M. Dallas, Philadelphia, Pa.

Oxydendrum arboreum (L.) DC.

Mrs H. C. Davis, Falmouth, Me.

Helvella infula Schaeff.

Mrs L. L. Goodrich, Syracuse

Chrysanthemum leucanthemum tubuliforme (Tenney)

Mrs C. W. Harris, Brooklyn

<i>Biatora chlorantha</i> Tuck.	<i>Cladonia bacillaris</i> (Del.) Nyl.
B. <i>laureri</i> (Hepp.) Tuck.	C. <i>caespiticia</i> (Pers.) Flk.
<i>Cetraria ciliaris</i> (Ach.) Tuck.	C. <i>cristatella</i> Tuck.
C. <i>glauca</i> (L.) Ach.	C. <i>delicata</i> (Ehrh.) Fr.
C. <i>lacunosa</i> Ach.	C. <i>fimb. coniocraea</i> (Flk.)
C. <i>oakesiana</i> Tuck.	C. <i>fimb. tubaeformis</i> Fr.

<i>Cladonia furcata</i> (Huds.) <i>Schrad.</i>	<i>Parmelia perlata</i> (L.) <i>Ach.</i>
C. <i>furc. paradoxa</i> <i>Wainio.</i>	P. <i>physodes</i> (L.) <i>Ach.</i>
C. <i>grac. dilatata</i> (Hoffm.)	P. <i>saxatilis</i> (L.) <i>Fr.</i>
C. <i>pyx. chlorophaea</i> (Spreng.)	P. <i>saxatilis sulcata</i> <i>Nyl.</i>
C. <i>pyx. neglecta</i> (Flk.)	<i>Peltigera horizontalis</i> (L.) <i>Hoffm.</i>
C. <i>rangiferina</i> (L.) <i>Hoffm.</i>	<i>Pertusaria communis</i> <i>DC.</i>
C. <i>turgida</i> (Ehrh.) <i>Hoffm.</i>	P. <i>velata</i> (Turn.) <i>Nyl.</i>
C. <i>verticillata</i> <i>Hoffm.</i>	<i>Physcia aquila detonsa</i> <i>Tuck.</i>
<i>Evernia furfuracea</i> (L.) <i>Mann.</i>	<i>Pyrenula nitida</i> <i>Ach.</i>
E. <i>prunastri</i> (L.) <i>Ach.</i>	<i>Pyxine sorediata</i> <i>Ach.</i>
<i>Graphis scripta</i> <i>Ach.</i>	<i>Ramalina calic. fastigiata</i> <i>Fr.</i>
<i>Lecanora pallida</i> (Schreb.) <i>Schaer.</i>	<i>Stereocaulon coralloides</i> <i>Fr.</i>
L. <i>subfusca</i> (L.) <i>Ach.</i>	<i>Sticta amplissima</i> (Scop.) <i>Mass.</i>
<i>Parmelia borrieri rudecta</i> <i>Tuck.</i>	S. <i>pulmonaria</i> (L.) <i>Ach.</i>
P. <i>olivacea</i> (L.) <i>Ach.</i>	<i>Umbilicaria pust. papulosa</i> <i>Tuck.</i>
P. <i>oliv. panniformis</i> <i>Nyl.</i>	<i>Usnea barbata ceratina</i> <i>Schaer.</i>
P. <i>perforata</i> (Jacq.) <i>Ach.</i>	U. <i>barbata florida</i> <i>Fr.</i>

Miss A. Hibbard, West Roxbury, Mass.

Lactarius hibbardae *Pk.*

Miss M. F. Miller, Washington, D. C.

Metzgeria conjugata *Lindl.*

Miss A. M. Patterson, Stanford University, Cal.

<i>Agaricus pattersonae</i> <i>Pk.</i>	<i>Lactarius xanthogalactus</i> <i>Pk.</i>
<i>Amanitopsis velosa</i> <i>Pk.</i>	<i>Pleurotus olearius</i> <i>DC.</i>
<i>Hypholoma appendiculatum</i> (Bull.)	<i>Pluteolus luteus</i> <i>Pk.</i>
H. <i>longipes</i> <i>Pk.</i>	<i>Psathyrella caespitosa</i> <i>Pk.</i>
<i>Lactarius rufulus</i> <i>Pk.</i>	<i>Tricholoma personatum</i> <i>Fr.</i>

Volvaria speciosa *Fr.*

Mrs A. M. Smith, Brooklyn

<i>Alsia abietina</i> <i>Sull.</i>	<i>Fontinalis kindbegii</i> <i>R. & C.</i>
<i>Antitrichia californica</i> <i>Sull.</i>	<i>Hylocomium loreum</i> (L.) <i>Schimp.</i>
<i>Aulacomnium androgynum</i> <i>Schwaegr.</i>	H. <i>proliferum</i> (L.) <i>Lindb.</i>
<i>Claopodium crispifolium</i> (Hook.)	II. <i>triquetrum</i> (L.) <i>B. & S.</i>
<i>Dicranoweisia cirrhata</i> <i>Lindl.</i>	<i>Isothecium brewerianum</i> <i>L. & J.</i>
<i>Dicranum bonjeani</i> <i>DeNot.</i>	<i>Neckera douglasii</i> <i>Hook.</i>
D. <i>fuscescens</i> <i>Turn.</i>	N. <i>menziesii</i> <i>Drumm.</i>
D. <i>scoparium</i> <i>Hedw.</i>	<i>Philonotis fontana</i> <i>Brid.</i>
<i>Eurhynchium oreganum</i> (Sull.)	<i>Plagiothecium undulatum</i> <i>B. & S.</i>
E. <i>stokesii</i> <i>B. & S.</i>	<i>Polytrichum juniperinum</i> <i>Willd.</i>
E. <i>stoloniferum</i> (Hook.)	<i>Racomitrium canescens</i> <i>Brid.</i>
<i>Fontinalis antipyretica</i> <i>L.</i>	<i>Scleropodium caespitosum</i> <i>B. & S.</i>
S. <i>colpophyllum</i> (Sull.) <i>Grout.</i>	

Miss T. L. Smith, Worcester, Mass.

Coprinus jonesii *Pk.*

Miss J. B. Spruance, Katahdin Iron Works, Me.
Gomphidius flavipes *Pk.*

Miss M. L. Sutliff, Sacramento, Cal.
Omphalia pyxidata (*Bull.*) *Fr.* | *Polyporus volvatus* *Pk.*

Mrs E. Watrous, Hague
Cypripedium arietinum *R. Br.* | *Helvella gracilis* *Pk.*
Dryopteris goldieana (*Hook.*) *Gray* | *Phegopteris polypodioides* *Fee*
Polystichum braunii (*Spenner*) *Fee*

Miss M. T. Wheeler, Keene Valley
Blitum capitatum *L.*

J. C. Arthur, Lafayette, Ind.
Puccinia agropyri *E. & E.* | *Puccinia crandallii* *P. & H.*

E. Bartholomew, Stockton, Kan.
Calvatia rubroflava (*Crag.*) *Morg.* | *Lactarius vellereus* *Fr.*
Collybia subsulphurea *Pk.* | *Lycoperdon pulcherrimum* *B. & C.*
Tylostoma mammosum *Fr.*

M. S. Baxter & V. Dewing, Rochester
Carex tribuloides reducta *Bailey* | *Meibomia paniculata* (*L.*) *Kuntze*
Cyperus filic. macilentus *Fernald* | *Polygonum lapathifolium* *L.*
Elcocharis ovata (*Roth.*) *R. & S.* | *Senecio obovatus* *Muhl.*
Euphorbia polygonifolia *L.* | *Sisymbrium altissimum* *L.*

H. C. Beardslee, Ashville, N. C.
Amanita russuloides *Pk.*

H. Blauvelt, Coeymans
Fusicladium pirinum (*Lib.*) *Fckl.*

F. S. Boughton, Pittsford
Lentinus lepideus *Fr.*

C. W. Boyd, Tupper Lake
Clavaria fistulosa *Fr.*

F. J. Braendle, Washington, D. C.
Amanita coccola *Scop.* | *Pholiota confragosa* *Fr.*
Amanitopsis volvata (*Pk.*) *Sacc.* | *Pleurotus lignatilis* *Fr.*
Armillaria mucida (*Schrad.*) *Pers.* | *P. ostreatus* (*Jacq.*) *Fr.*
Polyporus brumalis (*Pers.*) *Fr.*

S. H. Burnham, Sandy Hill

<i>Biatorella simplex</i> (Dav.) B. & R.	<i>Hygrophorus lacmus</i> Fr.
<i>Clitocybe laccata</i> Scop.	<i>Lecidea platycarpa</i> Ach.
<i>Clitopilus caespitosus</i> Pk.	<i>Polyporus admirabilis</i> Pk.
<i>Cortinarius croceus</i> Fr.	P. <i>hispidus</i> (Bull.) Fr.
<i>Crepidotus croceitinctus</i> Pk.	<i>Rinodina oreina</i> (Ach.) Mass.
<i>Geoglossum nigrum</i> (Fr.) Cke.	<i>Salix candida</i> Fluegge
<i>Viola vagula</i> Greene	

G. H. Chadwick, Albany

<i>Calypsotheca goeppertiana</i> Kühn	<i>Geaster hygrometricus</i> Pers.
<i>Morchella esculenta</i> (Pers.) Fr.	

T. T. Clohessy, Utica

Russula aeruginea Fr.

G. D. Cornell, Coopers Plains

<i>Crataegus acerba</i> S.	<i>Crataegus numerosa</i> S.
C. <i>amoena</i> S.	C. <i>pellecta</i> S.
C. <i>dissociabilis</i> S.	C. <i>plana</i> S.
C. <i>diversa</i> S.	C. <i>ramosa</i> S.
C. <i>frutescens</i> S.	C. <i>repulsans</i> S.
C. <i>fucata</i> S.	C. <i>rubrolutea</i> S.
C. <i>gracilis</i> S.	C. <i>suavis</i> S.
C. <i>inopinata</i> S.	C. <i>uncta</i> S.

J. J. Davis, Racine, Wis.

<i>Aecidium laricis</i> Kleb.	<i>Phytophthora thalictri</i> Wils. & Dav.
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S. Davis, Boston, Mass.

<i>Clavaria amethystinoides</i> Pk.	<i>Inocybe fuscodisca</i> (Pk.) Mass.
C. <i>ornatipes</i> Pk.	I. <i>hirtellum</i> Bres.
<i>Cortinarius nigrellus</i> Pk.	I. <i>infelix</i> Pk.
<i>Deconica bryophila</i> Pk.	I. <i>praetervisa</i> Quel.
<i>Eccilia cinericola</i> Pk.	I. <i>proximella</i> Karst.
E. <i>subacis</i> Pk.	I. <i>rimosa</i> (Bull.) Fr.
<i>Entoloma deminutivum</i> Pk.	<i>Leotia punctipes</i> Pk.
E. <i>murinum</i> Pk.	<i>Naucoria sororia</i> Pk.
<i>Flammula betulina</i> Pk.	<i>Omphalia gerardiana</i> Pk.
<i>Galera hypnorum</i> (Batsch) Fr.	<i>Panaeolus papilionaceus</i> Fr.
<i>Helvella macropus brevis</i> Pk.	<i>Pholiota marginella</i> Pk.
<i>Hygrophorus peckii</i> Atk.	<i>Psathyrella betulina</i> Pk.
<i>Hypholoma candolleianum</i> Fr.	<i>Russula pusilla</i> Pk.
<i>Inocybe agglutinata</i> Pk.	<i>Tricholoma personatum</i> Fr.
I. <i>deciens</i> Bres.	<i>Tubaria furfuracea</i> Pers.

W. T. Davis, New Brighton*Crataegus uniflora Muench.***J. Dearness, London, Ont.**

<i>Dermatea crataegicola Durand</i>	<i>Didymosphaeria thalictri E. & D.</i>
<i>Diaporthe microstroma E. & E.</i>	<i>Puccinia caricis-asteris Arth.</i>
<i>D. ulmicola E. & E.</i>	<i>Pucciniastrum potentillae Kom.</i>

F. Dobbin, Shushan

<i>Biatora prasina Fr.</i>	<i>Physcia hypoleuca (Muhl.) Tuck.</i>
<i>Cladonia digit. ceruchoides Wain.</i>	<i>Rinodina constans (Nyl.) Tuck.</i>
<i>Parmelia cetrata Ach.</i>	<i>Trentepohlia umbrina (Kütz.) Born.</i>

E. J. Durand, Ithaca

<i>Microglossum viride (Pers.) Boud.</i>	<i>Sclerotinia fructigena (Pers.)</i>
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S. C. Edwards, New Brighton

<i>Armillaria mellea Vahl</i>	<i>Fomes annosus Fr.</i>
	<i>Lenzites sepiaria Fr.</i>

C. E. Fairman, Lyndonville

<i>Eutypella angulosa (Nke.) Sacc.</i>	<i>Ophiochaete herpotricha (Fr.) Sacc.</i>
<i>Lophiotrema semiliberum (Desm.)</i>	<i>Sphaeropsis lyndonvillae Sacc.</i>
	<i>Sphaeropsis persicae E. & B.</i>

G. B. Fessenden, Boston, Mass.*Clitocybe subnigricans Pk.***O. E. Fischer, Detroit, Mich.**

<i>Clitocybe pulcherrima Pk.</i>	<i>Fistulina pallida B. & R.</i>
<i>C. morbifera Pk.</i>	<i>Pleurotus elongatipes Pk.</i>

N. M. Glatfelter, St Louis, Mo.

<i>Boletus pachypus Fr.</i>	<i>Boletus subglabripes Pk.</i>
	<i>Pluteus leoninus coccineus Cke.</i>

F. O. Grover, Oberlin, O.*Dothiorella aberrans Pk.***C. Guillet, Toronto, Ont.**

<i>Claudopus nidulans (Pers.) Pk.</i>	<i>Geaster limbatus Fr.</i>
<i>Clitocybe nobilis Pk.</i>	<i>Omphalia curvipes Pk.</i>
<i>Collybia hirticeps Pk.</i>	<i>O. vestita Pk.</i>
	<i>Sarcoscypha coccinea (Jacq.) Fr.</i>

C. C. Hanmer, East Hartford, Conn.
Leptoglossum microsporum (C. & P.) Sacc.

W. E. Harding, Linden
Centaurea solstitialis L.

G. G. Hedgcock, St Louis, Mo.
Ceratostromella moniliformis Hedgcock

G. T. Howell, Rockville, Ind.

<i>Daedalea confragosa</i> (Bolt.) Pers.	|	<i>Lentinus microspermus</i> Pk.
<i>Hypholoma rugocephalum</i> Atk.	|	L. <i>vulpinus</i> Fr.
<i>Lentinus cochleatus</i> Fr.		<i>Mycena leaiana</i> Berk.

C. E. Jones, Selkirk

<i>Conringia orientalis</i> (L.) Dum.		<i>Lotus corniculatus</i> L.
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C. H. Kauffman, Ann Arbor, Mich.

<i>Boletus atkinsoni</i> Pk.		<i>Hydnum kauffmani</i> Pk.
<i>Collybia campanella</i> Pk.		<i>Pleurotus porrigens</i> Pers.
<i>Clitopilus conissans</i> Pk.	|	<i>Polyporus aurantiacus</i> Pk.
<i>Cortinarius rubripes</i> Pk.	|	P. <i>osseus</i> Kalchb.
<i>Entoloma peckianum</i> Burt	|	<i>Polystictus velutinus</i> Fr.
		<i>Poria fuscocarnea</i> Pers.

R. H. Lane, Jolon, Cal.
Mycena acicula (Schaeff.) Fr.

G. G. Lansing, Romulus
Laestadia bidwellii Ellis

W. H. Leibelsperger, Fleetwood, Pa.
Cordyceps herculea (Schw.) Sacc.

C. G. Lloyd, Cincinnati, O.
Phycomyces nitens (Ag.) Kze.

J. McPherson, Trenton, N. J.
Phoenix dactylifera L. (undeveloped fruit)

A. P. Morgan, Harrison, O.
Marasmius siccus Schw.

G. E. Morris, Waltham, Mass.

<i>Amanita porphyria</i> Fr.	<i>Hygrophorus caprinus</i> (Scop.) Fr.
<i>Badhamia lilacina</i> (Fr.) Rost.	H. lacmus Fr.
<i>Balansia hypoxylon</i> (Pk.) Atk.	<i>Leotia chlorocephala</i> Schw.
<i>Clavaria platyclada</i> Pk.	<i>Leptonia abnormis</i> Pk.
<i>Clitocybe adirondackensis</i> Pk.	<i>Marasmius siccus</i> Schw.
<i>Cortinarius multiformis</i> Fr.	<i>Mycena epipterygia</i> Scop.
C. rigidus (Scop.) Fr.	M. galopoda Fr.
<i>Entoloma variabile</i> Pk.	<i>Nolanea conica</i> Pk.
<i>Fuligo ovata</i> (Schaeff.) Macbr.	<i>Panus strigosus</i> B. & C.
<i>Geoglossum americanum</i> Cke.	<i>Pholiota duroides</i> Pk.
<i>Guepinia aurea</i> Mont.	<i>Polyporus volvatus</i> Pk.
<i>Helvella gracilis</i> Pk.	<i>Tricholoma grammopodium</i> (Bull.)
<i>Hygrophorus borealis</i> Pk.	Fr.
<i>Tylostoma americanum</i> Lloyd	

G. E. Morris & S. Davis, Mass.

<i>Entoloma modestum</i> Pk.	<i>Mycena alcalina</i> Fr.
<i>Naucoria tabacina bicolor</i> Pk.	

W. A. Murrill, New York

By exchange

Diaporthe parasitica Murrill**J. J. Neuman, Horicon, Wis.**

<i>Hydnum sulcatipes</i> Pk.	<i>Poria medulla-panis</i> (Pers.) Fr.
<i>Irpex nodulosus</i> Pk.	P. obducens Pers.
<i>Myciadorpus induratus</i> Pk.	<i>Steccherinum adustulum</i> Banker

R. S. Phifer, Danville, Va.*Lycoperdon pulcherrimum* B. & C.**R. R. Riddell, Albany***Lepiota naucinoides* Pk.**F. J. Seaver, New York**

<i>Cordyceps militaris</i> (L.) Link	<i>Hypomyces aurantius</i> (Pers.) Fckl.
<i>Gloniopsis smilacis</i> (Schum.)	<i>Hypoxylon sassafras</i> Schw.
<i>Hypocrea gelatinosa</i> (Tode) Fr.	<i>Nectria aureofulva</i> C. & E.
H. patella C. & P.	N. cinnabarina (Tode) Fr.
<i>Hypoderma commune</i> (Fr.) Duby	<i>Rosellinia aquila</i> (Fr.) DeNot.

E. B. Sterling, Trenton, N. J.

<i>Hygrophorus psittacinus</i> (Schaeff.)	<i>Russula pusilla</i> Pk.
<i>Lycoperdon gemmatum</i> Batsch	<i>Tricholoma fumidellum</i> Pk.
<i>Volvaria speciosa</i> Fr.	

***Cladonia bacillaris* (Del.) Nyl.**

Decaying wood. Adirondacks. July. Mrs C. W. Harris.

***Cladonia delicata* (Ehrh.) Fl.**

Decaying wood. Near Chilson lake, Essex co. August. Mrs C. W. Harris. Sand Lake, Rensselaer co. C. H. Peck. This was formerly reported as a variety of *Cladonia squamosa*, but it is now deemed worthy of specific distinction.

***Clavaria ornatipes* n. sp.**

Clubs 1-2 inches tall, gregarious, sparingly branched; stem slender hairy, fuscous or brown, the branches irregular, terete, whitish, grayish or cinereous, the tips acute or obtuse; spores broadly elliptic or subglobose, .0003-.00045 of an inch long, .00024-.0003 broad.¹

In low swampy woods, usually among mosses. Sand Lake.

In New York State Museum Report 24, page 82 this was referred to *Clavaria trichopus* Pers. After seeing specimens of it from other localities and finding it constantly differing from the descriptions of that species, which is called "snowy white" and is much branched, it has seemed to us to be distinct.

***Clitocybe subcyathiformis* Pk.**

In damp places under shrubs. Karner. October. For the description of this species see article on "Edible Fungi."

***Clitopilus subplanus* n. sp.**

Pileus thin, broadly convex or nearly plane, slightly depressed in the center or distinctly umbilicate, glabrous, whitish or grayish white, flesh white; lamellae thin, close, adnate or slightly decurrent, dingy flesh colored; stem slender, glabrous, terete or compressed, stuffed or hollow, colored like the pileus; spores flesh colored, angular, uninucleate, .0004-.0005 of an inch long, .00024-.0003 broad.

Pileus 1-1.5 inches broad; stem 1-1.5 inches long, 1-2 lines thick.

Among fallen leaves and decaying vegetable matter in woods. Sand Lake, Rensselaer co. and Gansevoort, Saratoga co. July and August.

This is closely related to *Clitopilus carneopalbus* With. from which I have separated it because of the more umbilicate

¹ Latin descriptions of this and other new species may be found in the last chapter of this report.

pileus, the absence of any reddish tints in the pileus, its stuffed or hollow stem and specially of its larger spores which are longer than broad.

***Crataegus anomala* Sarg.**

Crown Point, Essex co. and Fort Ann, Washington co. Flowers in May, fruit ripens in September. The plants now referred to this species were formerly credited to *C. exclusiva* Sarg. from which they may be separated by the fruit which is distinctly narrowed toward the base. The species was founded on specimens collected in Canada.

***Crataegus suborbiculata* Sarg.**

Letchworth park, Wyoming co. Flowers in May, fruit ripens the last week in September. This species also was founded on specimens collected in Canada. It is placed in the group *Punctatae*.

The following species of *Crataegus* are here reported by name only as additions to our flora. The names are arranged under their respective groups. Nearly all are new species of which descriptions, localities and remarks are contained in the three chapters on *Crataegus*, immediately following the present one.

CRUS-GALLI

- Crataegus arduennae* S.
- C. cerasina* S.
- C. geneseensis* S.
- C. robusta* S.

PUNCTATAE

- Crataegus barbara* S.
- C. celsa* S.
- C. desueta* S.
- C. dewingii* S.
- C. notabilis* S.

PRUINOSAE

- Crataegus acerba* S.
- C. amoena* S.
- C. aridula* S.
- C. barryana* S.
- C. bronxensis* S.
- C. clintoniana* S.
- C. congestiflora* S.
- C. cruda* S.

***Crataegus dissociabilis* S.**

- C. foliata* S.
- C. gracilis* S.
- C. implicata* S.
- C. inusitula* S.
- C. livingstoniana* S.
- C. macera* S.
- C. macrocalyx* S.
- C. numerosa* S.
- C. oblita* S.
- C. ovatifolia* S.
- C. pellecta* S.
- C. placiva* S.
- C. plana* S.
- C. promissa* S.
- C. pulchra* S.
- C. radiata* S.
- C. ramosa* S.
- C. rubrolutea* S.
- C. strigosa* S.
- C. tortuosa* S.
- C. uncta* S.
- C. xanthophylla* S.

TENUIFOLIAE

<i>Crataegus</i>	<i>bella</i> S.
C.	<i>boothiana</i> S.
C.	<i>claytoniana</i> S.
C.	<i>conferta</i> S.
C.	<i>fucata</i> S.
C.	<i>gracilipes</i> S.
C.	<i>ignea</i> S.
C.	<i>insignata</i> S.
C.	<i>leptopoda</i> S.
C.	<i>luminosa</i> S.
C.	<i>nescia</i> S.
C.	<i>recta</i> S.
C.	<i>slavini</i> S.
C.	<i>spatifolia</i> S.
C.	<i>suavis</i> S.

MOLLES

<i>Crataegus</i>	<i>radians</i> S.
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FLABELLATAE

<i>Crataegus</i>	<i>dayana</i> S.
C.	<i>gloriosa</i> S.
C.	<i>letchworthiana</i> S.
C.	<i>limosa</i> S.
C.	<i>steubenensis</i> S.

COCCINEAE

<i>Crataegus</i>	<i>chateaugayensis</i> S.
C.	<i>harryi</i> S.

Crataegus neobaxteri S.

C.	<i>puberis</i> S.
C.	<i>spissa</i> S.
C.	<i>verrucalis</i> Pk.

INTRICATAE

<i>Crataegus</i>	<i>cornellii</i> S.
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ANOMALAE

<i>Crataegus</i>	<i>affinis</i> S.
C.	<i>brachyloba</i> S.
C.	<i>floridula</i> S.
C.	<i>inopinata</i> S.
C.	<i>repulsans</i> S.
C.	<i>simulans</i> S.
C.	<i>singularis</i> S.

TOMENTOSAE

<i>Crataegus</i>	<i>admiranda</i> S.
C.	<i>calvini</i> S.
C.	<i>comans</i> S.
C.	<i>efferata</i> S.
C.	<i>finitima</i> S.
C.	<i>frutescens</i> S.
C.	<i>honeoensis</i> S.
C.	<i>spinifera</i> S.
C.	<i>structilis</i> Ashe
C.	<i>venustula</i> S.

Cronartium ribicola Dietr.

On living leaves of black currant, *Ribes nigrum* L. Agricultural Experiment station grounds. Geneva. September 26, 1906. F. C. Stewart. This is an injurious parasitic fungus which has probably been recently introduced into this country. Its aecidial form, *Peridermium strobil*, occurs on the trunk and branches of white pine to which it is more injurious than the *Cronartium* is to currant bushes. Fortunately this form has not yet been detected in this country and it is possible that we may yet be free from it.

Diaporthe parasitica Murr.

Parasitic on the branches of chestnut trees to which it is injurious and eventually destructive. Various places in the vicinity of New

York. Our specimens are from Bronx park. There are two forms of the plant, a summer or conidial form which was collected in July, and a winter or perfect form bearing ascospores, which was collected in December. Received from W. A. Murrill in exchange. Specimens have also been communicated by G. G. Atwood which were collected in Westchester co.

***Flammula pulchrifolia* n. sp.**

Pileus fleshy but thin, hemispheric becoming convex, slightly viscid when moist, hygrophanous, fibrillose or, in large specimens, squamulose in the center and fibrillose on the margin, pale pink or pallid on the margin and pink in the center, flesh white, taste bitter and unpleasant; lamellae thin, close, adnate, sometimes slightly sinuate, whitish, soon bright tawny or Indian yellow becoming bright tawny ochraceous with age; stem equal or nearly so, stuffed or hollow, pallid, sometimes yellowish at the base, fibrillose at the top from the remains of the veil; spores bright tawny ochraceous in a thick layer, ochraceous buff in a thin one, .0003 of an inch long, .0002-.00024 broad.

Pileus 1-2 inches broad; stem 1-1.5 inches long, 1.5-2 lines thick.

Decaying wood of hemlock, *Tsuga canadensis* Carr. Menands, Albany co. July and August.

This beautiful species is easily recognized by the pink tint of the pileus, the bitter flavor of its flesh and the peculiar bright colors of its lamellae and spores. The fibrils at the top of the stem when stained by the falling spores might be mistaken for a slight annulus.

***Galium erectum* Huds.**

Abundant along a stream in an upland field 3 miles southeast of Utica. June. J. V. Haberer. The upright bedstraw is a recently introduced plant and is related to wild madder, *Galium mollugo* L.

***Hygrophorus coloratus* n. sp.**

Pileus fleshy, convex or nearly plane, often umbonate, even, very viscid or glutinous, yellowish red-orange or bright red, flesh white, yellow under the cuticle; lamellae unequal, distant, arcuate, adnate or decurrent, white, sometimes tinged with yellow, interspaces venose; stem equal or tapering upward, glutinous, stuffed or hollow, white or slightly tinged with yellow, sometimes when young showing a slight floccose veil near the top; spores .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 1-2.5 inches broad; stem 2-3 inches long, 2-4 lines thick.

Under tamarack and balsam fir trees. Fulton Chain, Herkimer co. October.

This is a beautiful species of *Hygrophorus* closely related to *H. speciosus* Pk. and *H. aureus* Arrh. From the last I have separated it because of its different habitat, its frequently umbonate pileus, its white or whitish stem and its partial floccose white veil. By this last character and its persistently red or orange colored pileus it is separable from *H. speciosus* Pk. and *H. bresadolae* Quel. It is possible that further observation may prove that all these are forms of one variable species.

***Hygrophorus lacmus* Fr.**

Ground in woods of deciduous trees. Wilburs Basin, Saratoga co. November. S. H. Burnham. A single specimen.

***Hypocrea polyporoidea* B. & C.**

Bark and decorticated wood of beech, *Fagus americana* Sweet. Adirondack mountains. Lake Pleasant, Hamilton co. and Star lake, St Lawrence co. August.

***Lactarius minusculus* Burl.**

Among fallen leaves and mosses under white birches. Menands, Albany co. July. This species has hitherto been confused with *L. subdulcis* Fr. and has been separated because of its smaller size and acrid or tardily acrid taste.

***Leaia piperata* Banker**

Decaying wood. East Schaghticoke, Rensselaer co. H. J. Banker. Meadowdale, Albany co. September. Remarkable for its dissected pileus and its hot peppery flavor.

***Lecidea platycarpa* Ach.**

Rocks. Vaughns, Washington co. August. S. H. Burnham.

***Lophiotrema semiliberum* (Desm.) Sacc.**

Dead grass stems. Lyndonville, Orleans co. May. C. E. Fairman.

***Lotus corniculatus* L.**

Selkirk, Albany co. C. E. Jones. An introduced plant sparingly naturalized.

***Metzgeria conjugata* Lindb.**

Perpendicular surface of rocks. Shandaken, Ulster co. June. Miss M. F. Miller.

***Monilia crataegi* Diedicke**

Parasitic on living leaves of various species of thorn bushes. It causes the leaves to turn brown and die and is therefore more or less injurious to the plant it attacks, according to the severity of the attack. The fungus is at first whitish, but soon becomes cinereous. When fresh it emits a strong odor. In the typical form of the fungus the spores are said to be $13\ \mu$ long, $11\ \mu$ broad. In our specimens they vary from $12-20\ \mu$ long, and $11-12\ \mu$ broad. Painted Post, Steuben co. Also Clayton, Jefferson co. and near Albany. May and June.

***Myxosporium necans* n. sp.**

Acervuli in longitudinal series, erumpent, whitish within, spores oozing out in whitish or yellowish white tendrils or masses; spores oblong or elliptic, .00024-.0004 of an inch long, .00008-.000012 broad, often binucleate, supported on slender sporophores.

Bark of living chokecherry, *Prunus virginiana* L. North Greenbush, Rensselaer co. June. The fungus attacks the trunk near the base and soon kills the shrub.

***Nolanea suaveolens* n. sp.**

Pileus submembranous, convex, umbilicate, obscurely fibrillose or unpolished, indistinctly striate on the margin, smoky brown; lamellae thin, unequal, close, adnate, whitish becoming dingy pink; stem slender, glabrous, hollow, brown; spores angular, uninucleate, .0004-.0005 of an inch long, .00024-.0003 broad.

Pileus 6-10 lines broad; stem 1.5-2 inches long, .5 of a line thick. Woods. Sand Lake, Rensselaer co. August.

The dried specimens emit an agreeable odor similar to that of *Lactarius camphoratus* or *L. glyciosmus*. This character is suggestive of the specific name.

***Parmelia perforata* (Jacq.) Ach.**

Trees. Near Chilson lake, Essex co. June. Mrs C. W. Harris.

***Parmelia cetrata* Ach.**

Trunks of trees in swamps. Shushan, Washington co. May. Frank Dobbin.

***Physcia hypoleuca* (Muhl.) Tuckerm.**

Trunks of trees. Shushan. April. Frank Dobbin.

***Pholiota duroides* Pk.**

Ground in woods near Syracuse. August. G. E. Morris and C. H. Peck. For description of this species see article on "New York Species of *Pholiota*."

***Polyporus alboluteus* E. & E.**

Decaying prostrate trunk of spruce, between Long lake and Mud pond, Hamilton co. Imperfect specimens of this rare species were formerly referred to *Lenzites sepiaria dentifera*, in New York State Museum Report 40, page 75. It has been found but once in our State. The type specimens were collected in Colorado, the only other locality at present known for the species. A new genus, *Aurantiporellus*, has recently been founded by Dr Murrill on this species.

***Polyporus spraguei* B. & C.**

On old stumps of oak and chestnut. Sand Lake, Rensselaer co. and Wading River, Suffolk co. July and August.

***Polystictus montagnei* Fr.**

Ground. Sand Lake, Rensselaer co. and Piseco, Hamilton co. This is a rare species with us. A single specimen was found in each locality. It is distinguished from allied species by the large size of its pores. The pileus is often very irregular.

***Rinodina oreina* (Ach.) Mass.**

Peaked rock near Shushan, Washington co. July. S. H. Burnham.

***Russula aeruginea* Fr.**

Near Utica. August. T. T. Clohessy. Near Gansevoort, Saratoga co. C. H. Peck.

Sphaeropsis lyndonvillae Sacc

Dead branches of a cultivated species of *Althaea*. Lyndonville, Orleans co. C. E. Fairman.

Sphaeropsis persicae E. & B.

Dead branches of flowering almond, *Prunus japonica* Thunb. Lyndonville. May. C. E. Fairman.

Stereocaulon coralloides Fr.

Rocks. Mt Marcy. July. C. H. Peck. Near Chilson lake, Essex co. June. Mrs C. W. Harris.

Stropharia bilamellata Pk.

In a plowed field near Newark, Wayne co. September. B. C. Williams. See article on "Edible Fungi."

Trentepohlia umbrina (Kütz.) Born.

Bark of canoe birch, *Betula papyrifera* Marsh. Shushan, Washington co. May. Frank Dobbin.

Tubercularia davisiana Sacc. & Trav.

Parasitic on *Rhytisma salicinum* (Pers.) Fr. Catskill mountains.

Viola vagula Greene

Low damp ground near Vaughns, Washington co. May. S. H. Burnham.

SOME ADDITIONS TO THE CRATAEGUS FLORA OF
WESTERN NEW YORK

BY C. S. SARGENT

The following paper is based chiefly on collections and observations made by Mr John Dunbar of Rochester in Buffalo and Niagara Falls between 1901 and 1906. In it are also included a few species distinguished at Rochester since the publication in the fourth volume of the Proceedings of the Rochester Academy of Science in 1903 of my paper on *Crataegus in Rochester*, and a few others discovered in the valley of the Genesee river south of Rochester by Messrs Baxter and Dewing of Rochester, and in Canandaigua and Chapinville, Ontario co. by the Rochester botanists.

I NUTLETS WITHOUT VENTRAL CAVITIES

I CRUS-GALLI

Leaves obovate, cuneate, coriaceous, dark green and shining above, mostly glabrous, usually serrate only above the middle, their veins thin except on vigorous shoots and often within the parenchyma; calyx glabrous; fruit oblong to subglobose; nutlets 1-3, obtuse and rounded at the ends, prominently ridged on the back.

Veins within the parenchyma

Stamens 10 or less

 Anthers rose color...1 *C. crus-galli* var. *pyracanthifolia*

 Anthers white 2 *C. arduennae*

Veins prominent

 Anthers pale pink

 Stamens 9-10 3 *C. geneseensis*

 Stamens 10-20

 Flowers at least 1.8 cm in diameter, in broad many-flowered corymbs; leaves broadly ovate; fruit crimson; spines stout...4 *C. robusta*

 Flowers not more than 1.2 cm in diameter, in few-flowered corymbs; leaves narrowly obovate; fruit bright cherry-red; spines slender 5 *C. cerasina*

***Crataegus crus-galli* var. *pyracanthifolia* Aiton**

Hort. Kew. II. 170 (1788). Sargent, Silva N. Am. XIII. 39, t. 637;

Bot. Gazette XXXV. 100; Man. 369.

Niagara Falls, J. Dunbar and C. S. Sargent (* 17), September 16, 1904, J. Dunbar, September 27, 1905 and June 1906; Rochester, Baxter and Dewing (* 314), June 10 and October 15, 1905; also at Niagara on the Lake, Ontario and in Delaware.

***Crataegus arduennae* Sargent**

Bot. Gazette XXXV. 377 (1903); Man. 373, f. 291; Acad. Sci. Phila. Proc. 582 (1905).

South Buffalo, B. H. Slavin (* 14), June 6 and October 1906; also southern Ontario, through southern Michigan to northeastern Illinois, and in eastern Pennsylvania.

Crataegus arduennae was first described as entirely glabrous but there are often a few hairs on the upper side of the midribs of the young leaves; and a few minute hairs can be found occasionally on the young pedicels of the Buffalo plant.

***Crataegus geneseensis* n. sp.**

Glabrous with the exception of a few hairs on the young leaves. Leaves obovate-oblong, short pointed at the rounded or acute apex, gradually narrowed from near the middle to the concave-cuneate entire base, and finely serrate above, with usually incurved teeth; nearly fully grown when the flowers open about the 1st of June and then thin, slightly hairy along the upper side of the midribs, dark yellow-green and lustrous above and pale below, and at maturity subcoriaceous, dark green and very lustrous on the upper surface, pale yellow-green on the lower surface, 4.5-5 cm long and 2-2.5 cm wide, with thin prominent midribs, and conspicuous primary veins extending obliquely to above the middle of the leaf; petioles slender, narrowly wing-margined sometimes nearly to the base, slightly hairy on the upper side while young, soon glabrous, 5-8 mm long; leaves on vigorous shoots oval and acuminate to obovate and rounded at the apex, concave-cuneate at the base, coarsely serrate, often deeply lobed, 6-7 cm long and 3.5-4 cm wide, with thick midribs, and stout broadly winged rose colored petioles. Flowers 1-1.2 cm in diameter, on slender pedicels, in wide lax many-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes slender, elongated, acuminate, minutely glandular serrate near the base, reflexed after anthesis; stamens 9-11, filaments persistent on the fruit; anthers pink; styles 1, 2 or rarely 3. Fruit ripening in the middle of October, on slender drooping reddish pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, scarlet, lustrous, marked by large dark dots, 1.2-1.5 cm long and 1-1.2 cm wide; calyx little enlarged, with a deep narrow cavity, and spreading lobes, their tips often deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 1-3, obtuse at the ends, rounded and slightly grooved on the back, about 8 mm long, and 6 mm in diameter.

A tree 3-4 m high, with a trunk sometimes 3 dm in diameter, widespreading branches forming a broad flat topped open head, and slender slightly zigzag branchlets light orange-green and marked by many pale lenticels when they first appear, pale orange colored in their first season and dull gray-brown the following year, and armed with slender nearly straight, light brown ultimately gray spines 4-4.5 cm long and persistent and become branched on old stems.

Banks of the Genesee river above Rochester, J. Dunbar (* 1 type), June 1 and October 23, 1903; Tuscarora, Baxter and Dewing (* 295, a much older tree with smaller leaves), September 14, 1904, and May 30, 1905.

Crataegus robusta n. sp.

Leaves glabrous, oblong-obovate, gradually narrowed or rounded and usually short pointed at the apex, narrowed from above the middle to the cuneate entire base, and finely doubly serrate above, with straight glandular teeth; nearly fully grown when the flowers open about the 10th of June and then thin and lustrous above, and at maturity subcoriaceous, dark green and very lustrous on the upper surface, pale yellow-green on the lower surface, 5-6 cm long and 3.5-4 cm wide; leaves on vigorous shoots often 8-9 cm long and 5-6 cm wide, with prominent pale yellow midribs and 6 or 7 pairs of prominent primary veins; petioles stout, wing-margined often to below the middle, glandular early in the season toward the apex, often tinged with red in the autumn, 7-12 mm in length. Flowers 1.8 cm in diameter, on elongated slender glabrous pedicels, in broad lax many-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, glandular serrate; stamens 10-20; anthers pale pink; styles usually 2 or 3, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the end of September, on long slender drooping pedicels, in few-fruited clusters, short-oblong to obovate, crimson, lustrous, marked by occasional large pale dots, about 2 cm long and 7-8 mm wide; calyx prominent, with a broad shallow cavity, and spreading and reflexed or appressed narrow lobes, dark red on the upper side below the middle and often deciduous from the ripe fruit; flesh thin, yellow-green, dry and mealy; nutlets 2 or 3, gradually narrowed at the ends, rounded at the base, ridged on the back, with a low grooved ridge, about 1 cm. long, and 5 mm wide.

A tree 5-6 m high, with a trunk covered with dark scaly bark

and sometimes 3 dm in diameter, thick widespreading branches forming a symmetrical round-topped head often 6-7 m in diameter, and stout nearly straight pale orange-brown lustrous branchlets marked while young with oblong pale lenticels, light gray and shining in their second season, and armed with straight red-brown shining spines 5-7 cm in length, persistent and becoming branched on the old trunk and branches.

Banks of the Niagara river above the falls, J. Dunbar and C. S. Sargent (* 16 type), September 16, 1904, J Dunbar, June 12, 1905; Buffalo, J. Dunbar (* 26), September 30, 1904, May 28, June 12 and September 26, 1905.

***Crataegus cerasina* n. sp.**

Leaves oblong-obovate, acute or rounded at the apex, gradually narrowed and concave-cuneate at the entire base and sharply doubly serrate above, with straight glandular teeth; nearly half grown when the flowers open about the 10th of June and then glabrous with the exception of a few caducous pale hairs on the upper side of the midribs, thin, dark green and lustrous above and pale below, and at maturity subcoriaceous, dark yellow-green and shining on the upper surface, light yellow-green on the lower surface, 5-6.5 cm long and 2.6-3.5 cm wide, with slender yellow midribs, and 5 or 6 pairs of thin, prominent primary veins; petioles slender, wing-margined to below the middle, 1.2-1.5 cm in length; leaves on vigorous shoots coriaceous, often slightly lobed toward the apex, more coarsely serrate and sometimes 7 cm long and 5 cm wide, with stout midribs, more prominent veins, and thick broadly winged reddish petioles about 1 cm in length. Flowers 1.2 cm in diameter, on long slender glabrous pedicels, in few usually 7-10-flowered compact corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, elongated, acuminate, glandular serrate, slightly hairy on the inner surface toward the base, reflexed after anthesis; stamens 10-20; anthers pale pink; styles usually 2. Fruit ripening from the middle to the end of September, on slender reddish pedicels, in 1-5-fruited drooping clusters, short-oblong, full and rounded at the ends, bright cherry-red, very lustrous, marked by occasional large pale dots, 1-1.2 cm long and 8-10 mm wide; calyx little enlarged, with a deep narrow cavity, and slender spreading, persistent lobes dark red on the inner surface toward the base and slightly serrate near the middle; flesh thin, yellow, dry and mealy; nutlets 2, full and rounded at the ends, ridged on the back, with a high broad ridge, 7-8 mm long, and 4-5 mm wide.

A tree 5-7 m high, with a tall trunk 2-3 dm in diameter, covered with ashy gray scaly bark, spreading and ascending branches forming a wide open round-topped head, and slender nearly straight branchlets light olive-green and glabrous when they first appear, becoming light orange color and lustrous during their first season and dark gray-brown the following year, and armed with many slender nearly straight bright chestnut-brown shining ultimately dark gray-brown spines 3-5 cm in length.

Niagara Falls, J. Dunbar and C. S. Sargent (*22, type), September 16, 1904, J. Dunbar, June 12, 1905; also (*22A and 22B), J. Dunbar and C. S. Sargent, September 16, 1904, and J. Dunbar, June 12, 1906.

II PUNCTATAE

Leaves usually thin, mostly acute or occasionally rounded at the apex, their veins prominent; stamens 20; fruit short-oblong or rarely subglobose or obovate, often conspicuously punctate; flesh usually dry and mealy.

Anthers rose color or yellow; leaves obovate, often acutely lobed above the middle, especially on vigorous shoots, more or less villose below; fruit flattened at the ends, marked by large dots, dark red or bright yellow 1 *C. punctata*

Anthers dark rose color; leaves rhombic, glabrous at maturity

Leaves subcoriaceous; flowers on stout villose pedicels; calyx thickly coated with matted white hairs; fruit subglobose, crimson, very lustrous 2 *C. celsa*

Leaves thin; flowers on slender glabrous pedicels; calyx glabrous; fruit short-oblong or sometimes slightly obovate, orange-red slightly lustrous 3 *C. notabilis*

Anthers pink; corymbs and leaves glabrous

Leaves oblong-obovate, acuminate at the base; fruit obovate.....4 *C. barbara*

Leaves ovate to oval or orbicular, abruptly narrowed at the base; fruit short-oblong 5 *C. dewingii*

Crataegus punctata Jacquin

Hort. Vind. 1. 10, t. 28 (1770). Sargent, Silva N. Am. IV. 103, t. 184; Man. 389, f. 308; Acad. Sci. Phila. Proc. 583 (1905).

Buffalo, J. Dunbar (*5), May 21 and September 25, 1903; also from Canada to Illinois and to the mountains of western North Carolina.

Crataegus celsa n. sp.

Leaves rhombic to oblong-obovate, acute or acuminate at the apex, gradually narrowed and concave-cuneate at the entire base, finely doubly serrate above, with incurved glandular teeth, and slightly divided above the middle into 4 or 5 pairs of small acute lobes; about half grown when the flowers open during the last week of May and then membranaceous, light yellow-green and sparingly villose especially on the midribs and veins, and at maturity subcoriaceous, glabrous, dark green and lustrous on the upper surface, pale on the lower surface, 5-7 cm long and 3.5-5 cm wide, with slender prominent midribs and 5-7 pairs of primary veins extending obliquely toward the apex of the leaf and deeply impressed on its upper side; petioles slender, narrowly wing-margined often nearly to the middle, slightly villose while young, soon becoming glabrous, often rose color in the autumn, 1.5-2 cm in length; stipules linear, minutely glandular, fading-brown, caducous; leaves on vigorous shoots thicker, more coarsely serrate and sometimes 9-10 cm long and 8-9 cm wide, with thick rose colored midribs and stout broadly winged petioles. Flowers 1.5 cm in diameter, on stout villose pedicels, in compact many-flowered hairy corymbs, with linear to linear-obovate slightly glandular caducous bracts and bractlets; calyx-tube narrowly obconic, thickly coated with long matted white hairs, the lobes wide, acuminate, glandular serrate, glabrous on the outer, villose on the inner surface below the middle; stamens 20; anthers small, dark rose color; styles usually 3. Fruit ripening early in October, on stout reddish drooping pedicels, in wide many-fruited clusters, subglobose, full and rounded at the ends, crimson, very lustrous, marked by large pale dots, about 1 cm long and 8 or 9 mm wide; calyx prominent, with a deep narrow cavity, and large spreading, closely appressed, light green persistent lobes; flesh thin, yellow, dry and mealy; nutlets 3, full and rounded at the ends, or narrow and acuminate at the apex, rounded and slightly ridged on the back, with a broad low ridge 7-8 mm long, and 5 mm wide.

An arborescent shrub sometimes 7 m high, with numerous stems covered with dark gray scaly bark, spreading and ascending branches, and stout slightly zigzag branchlets dark olive-green and sparingly hairy when they first appear, becoming light orange-brown, very lustrous and marked by large oblong lenticels in their first season and pale gray-brown the following year, and armed with numerous stout nearly straight purple shining spines 5-6 cm long, often pointing toward the base of the branch, and generally persistent on old stems.

Niagara Falls, J. Dunbar (* 32, type), September 28, 1905, and May 28, 1906.

Similar to *Crataegus pausiaca* Ashe, in habit, in the color of the branchlets and in the shape and venation of the leaves, this species differs from it in its larger flowers on much shorter pedicels, in the more villose calyx-tube and much broader, more foliaceous calyx-lobes, and in the smaller subglobose crimson fruit on shorter stalks.

***Crataegus notabilis* n. sp.**

Leaves rhombic, acuminate, gradually narrowed and acute at the entire base, coarsely doubly serrate above, with incurved or straight glandular teeth, and divided above the middle into 2 or 3 pairs of small acuminate spreading lobes; when they unfold slightly tinged with red and glabrous with the exception of a few scattered pale hairs along the upper side of the midribs, membranaceous and about half grown when the flowers open at the end of May, and at maturity thick and firm, glabrous, smooth and dark yellow-green on the upper surface, pale blue-green on the lower surface, 6-7 cm long and 4-4.5 cm wide, with prominent yellow midribs, and thin primary veins extending very obliquely to the points of the lobes; petioles slender, broadly wing-margined often to below the middle, occasionally furnished early in the season with minute deciduous glands, glabrous, 2-3 cm in length; stipules linear, glandular, fading brown, caducous. Flowers 1.2 cm in diameter, on long slender glabrous pedicels, in usually 6-8-flowered lax thin-branched corymbs, with linear bracts and bractlets, the lower peduncles from the axils of the upper leaves; calyx-tube broadly obconic, glabrous, the lobes slender, acuminate, entire or slightly dentate above the middle, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 20; filaments persistent on the ripe fruit; anthers large, red-purple; styles 3-5. Fruit ripening early in October, on long drooping pedicels, in few-fruited clusters, short-oblong or slightly obovate, full and rounded at the ends, orange-red, marked by occasional large dark dots, 8-10 mm long, 7-8 mm in diameter; calyx prominent, with a short tube, a deep narrow cavity, and slender spreading persistent lobes; flesh thin, yellow, hard and dry; nutlets 3-5, rounded at the ends, ridged on the back, with a broad, low grooved ridge, light colored, 5-6 mm long, and about 4 mm wide.

An arborescent shrub 5-7 m high, with stout ascending and spreading stems covered with dark gray scaly bark, small spreading

branches forming a narrow open head, and slender slightly zigzag glabrous branchlets dull orange-green and marked by many small pale lenticels when they first appear, becoming light orange-brown or chestnut-brown and lustrous in their first season and dull gray-brown, the following year, and armed with numerous very slender nearly straight dark chestnut-brown or purplish shining ultimately ashy gray spines 3.5-5 cm in length, persistent and becoming branched on old stems.

Buffalo, J. Dunbar (*14, type), June 1 and September 24 and 30, 1904.

***Crataegus barbara* n. sp.**

Glabrous with the exception of the hairs on the inner surface of the calyx-lobes. Leaves oblong-obovate, acuminate, gradually narrowed to the long slender acuminate entire base, finely serrate above, with minute incurved teeth, and only slightly lobed near the apex; nearly fully grown when the flowers open during the first week of June and then thin, dark green, smooth and lustrous above and pale below, and at maturity subcoriaceous, dark green and very lustrous on the upper surface, pale on the lower surface, 5.5-7 cm long and 2.5-3 cm wide, with stout yellow midribs, and thin very prominent primary veins extending obliquely toward the apex of the leaf; petioles slender, narrowly wing-margined nearly to the middle, 1.5-2.5 cm in length; leaves on vigorous shoots oblong to obovate, narrowed to the ends, more coarsely serrate, often deeply divided into 1 or 2 narrow acuminate lateral lobes, frequently 9-10 cm long and 4.5-6 cm wide, with stout broadly winged petioles. Flowers 1.3-1.5 cm in diameter, on long slender pedicels, in wide lax many-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, finely glandular serrate, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 20; anthers pale pink; styles 2-4. Fruit ripening the middle of October, on long slender reddish pedicels, in drooping few-fruited clusters, oblong-obovate, rounded at the apex, gradually narrowed from below the middle, abruptly compressed at the often oblique base and decurrent on the pedicels; calyx little enlarged, with a very narrow deep cavity, and spreading closely appressed persistent lobes, flesh thin, juicy, pale yellow; nutlets 3-5, acute at the ends or narrowed and rounded at the base, ridged on the back, with a low grooved ridge, 7-8 mm long, and 4-5 mm wide.

A tree sometimes 7 m high, with a short trunk 2-2.5 dm in diameter, erect branches forming a broad open head, and stout zigzag glabrous branchlets, light orange-yellow and marked by large pale lenticels when they first appear, becoming light orange color and lustrous in their first season, and armed with numerous nearly straight or curved spines 2.5-6 cm long and becoming dark gray or purple in their second or third seasons.

Brighton, near Rochester, B. H. Slavin (* 2, type), October 14, 1903, and June 4, 1905.

Crataegus dewingii n. sp.

Leaves ovate to oval or rarely orbicular, acuminate, abruptly concave-cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and very slightly divided above the middle into 4 or 5 pairs of small acuminate lobes; deeply tinged with red when they unfold, about half grown when the flowers open at the end of May and then thin, yellow-green and glabrous with the exception of a few caducous hairs along the upper side of the midribs, and at maturity thin but firm in texture, dark green and lustrous on the upper surface, pale bluish green on the lower surface, 5-7 cm long and 4-5 cm wide, with stout yellow midribs, and thin primary veins arching obliquely to the points of the lobes; petioles slender, wing-margined at the apex, villose on the upper side while young, slightly glandular, 2.5-3 cm in length; leaves on vigorous shoots often oblong-ovate, more coarsely serrate, deeply divided into broad lateral lobes and 5-6 cm long. Flowers 1.8-2 cm in diameter, on slender glabrous pedicels, in 4-13-flowered lax corymbs, with broadly obovate to linear-obovate caducous bracts and bractlets fading brown; calyx-tube broadly obconic, glabrous, the lobes abruptly narrowed from the base, broad, acuminate, entire or slightly serrate near the middle, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 20; anthers pink; styles 4 or 5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening from the middle to the end of September, on stout red pedicels, in few-fruited drooping clusters, short-oblong, full and rounded at the ends, crimson, pruinose, becoming lustrous, marked by many small pale dots, 1-1.2 cm in diameter; calyx little enlarged, with a broad deep cavity, and spreading often incurved persistent lobes villose on the upper side; flesh thin, hard, dry and mealy; nutlets 4 or 5, gradually narrowed and rounded at the ends, ridged on the back, with a high narrow ridge, 7-8 mm long, and 4-5 mm wide.

A tree sometimes 8 m high, with a trunk 2 m long and 1.5 dm in diameter, covered with ridged and scaly gray bark, drooping and widespreading branches, and slender nearly straight glabrous branchlets dull red and marked by pale lenticels when they first appear, becoming bright chestnut-brown and lustrous in their first season and pale gray-brown the following year, and armed with few slender nearly straight chestnut-brown shining spines 3-3.5 cm long.

Open thickets in clay soil, Belfast, Allegany co., Baxter and Dewing (* 285, type), September 14, 1904, May 29 and September 14, 1905; (* 212X), May 30, 1903, September 14, 1904, September 19, 1905.

This interesting species, which is doubtfully referred to this group, is named for Mr Vincent Dewing who with Mr Baxter has carefully studied and industriously collected the large number of species of *Crataegus* growing in several of the towns of the upper Genesee valley in New York.

III PRUINOSAE

Fruit subglobose to short-oblong or obovate, red or green, often slightly 5-angled, generally pruinose especially during the summer; flesh hard and dry; leaves thin to subcoriaceous.

Stamens 20

Anthers rose color, pink or red

Leaves glabrous

Corymbs glabrous

Corymbs many-flowered.....1 *C. pruinosa*

Corymbs few-flowered

Leaves cuneate at the base; fruit conspicuously 5 angle and mammillate below the middle.....2 *C. arcana*

Leaves often rounded at the broad base; fruit not mammillate

Leaves subcoriaceous; flowers not less than 1.8 cm in diameter, on long pedicels.....3 *C. gracilis*

Leaves thin; flowers 1.2-1.4 cm in diameter, on short pedicels.....4 *C. amoena*

Corymbs villose.....5 *C. clintoniana*

Young leaves roughened above by short white hairs.....6 *C. oblita*

Anthers yellow

Leaves glabrous 7 *C. cognata*

Leaves slightly hairy above while young

Leaves oblong-ovate; corymbs many-flowered; spines short and stout 8 *C. formosa*

Leaves broadly ovate; corymbs few-flowered; spines long and slender 9 *C. leiophylla*

Stamens 10 or less

Anthers rose color, purple or pink

Leaves glabrous

Fruit short-oblong

Leaves slightly lobed; fruit cherry-red, pruinose, 1-1.2 cm in diameter.....10 *C. pulchra*Leaves deeply lobed; fruit crimson, not pruinose, 1.5-1.7 cm in diameter.....11 *C. radiata*Fruit obovate 12 *C. aridula*

Leaves villose above while young

Fruit obovate

Flowers not more than 1.6 cm in diameter, in very compact 4-6-flowered corymbs; stamens usually 5; anthers dark rose color 13 *C. congestiflora*Fruit subglobose 15 *C. maineana*Flowers at least 2cm in diameter, in broad loose corymbs; stamens 10; anthers pink.....14 *C. plana*Fruit subglobose.....15 *C. maineana*

Leaves scabrate above while young

Leaves thick

Leaves blue-green

Stamens 10; fruit short-oblong to obovate...16 *C. placiva*Stamens 5; fruit obovate.....17 *C. tortuosa*Leaves yellow-green 18 *C. xanthophylla*

Leaves thin

Leaves blue-green

Flowers in 2-8-flowered compact corymbs; fruit subglobose, pruinose.....19 *C. implicata*Flowers in wide lax many-flowered corymbs; fruit oblong-obovate, not pruinose.....20 *C. promissa*

Leaves yellow-green

Leaves scabrate at maturity

Flowers not more than 1.5 cm in diameter; calyx-lobes glabrous; fruit short-oblong, on drooping pedicels.....21 *C. strigosa*Flowers at least 2 cm in diameter; calyx-lobes villose on the inner surface; fruit obovate, on erect pedicels.....22 *C. barryana*

Leaves glabrous at maturity

Anthers dark rose color; calyx-lobes short and broad; fruit on long drooping pedicels 23 *C. foliata*Anthers pale pink; calyx-lobes long and slender; fruit on shorter pedicels 24 *C. cruda*

Anthers yellow; flowers on villose pedicels, in compact 5-7-flowered corymbs; styles hirsute to the middle; young leaves scabrate.....

.....25 *C. inusitula*

***Crataegus pruinosa* K. Koch**

Verhandl. Preuss. Gart. Verein, neue Reihe 1. 246 (1854). Sargent, Silva N. Am. XIII. 61, t. 648; Man. 411, f. 331; Acad. Sci. Phila. Proc. 585 (1905).

Buffalo, J. Dunbar (* 2, 6 and 45), 1902-5.

***Crataegus arcana* Beadle**

Bilt. Bot. Studies 1. 122 (1902). Sargent, Bot. Gazette XXXV. 101; Acad. Sci. Phila. Proc. 588 (1905).

Niagara Falls, J. Dunbar and C. S. Sargent (* 24), September 16, 1904; J. Dunbar, May 28, 1905; also eastern Pennsylvania to western North Carolina.

***Crataegus gracilis* n. sp.**

Leaves ovate, acuminate, rounded or abruptly cuneate at the broad entire base, sharply doubly serrate above, with straight glandular teeth, and divided into 3 or 4 pairs of short acuminate lateral lobes; when they unfold deeply tinged with red and glabrous with the exception of occasional caducous hairs along the upper side of the midribs, nearly fully grown when the flowers open at the end of May and then membranaceous and dull yellow-green, and at maturity subcoriaceous, dark blue-green, smooth and lustrous on the upper surface, paler on the lower surface, 5-6 cm long and 3.5-4 cm wide, with slender yellow midribs and 4 or 5 pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, glandular, with occasional scattered dark glands, 8-10 mm long; stipules linear or linear-falcate, glandular, fading rose color, deciduous; leaves on vigorous shoots coriaceous, nearly triangular, mostly truncate at the base, coarsely serrate, deeply lobed, often 8-9 cm long and 9-10 cm wide, with stout reddish midribs, broadly margined conspicuously glandular petioles 2-2.5 cm in length, and foliaceous lunate coarsely serrate stipules. Flowers about 1.8 cm in diameter, on long slender glabrous pedicels, in compact 6-10-flowered corymbs, with linear glandular red bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes abruptly narrowed from broad bases, slender, acuminate, glabrous, entire or occasionally minutely glandular toward the base; stamens 20; anthers pale pink, filaments persistent on the fruit; styles 3-5, surrounded at the base by tufts of long pale hairs. Fruit ripening late in September, on slender drooping pedicels, in few-fruited clusters, depressed-globose, green tinged with red or orange color, pruinose, about 1 cm in diameter; calyx

prominent, with a short tube, a broad shallow cavity, and wide-spreading and slightly incurved lobes, dark red on the upper side toward the base; flesh thin, dry, greenish yellow; nutlets 3-5, full and rounded at the base, narrowed and rounded at the apex, ridged on the back, with a high rounded ridge, dark colored, 8-9 mm long, and about 5 mm wide.

A shrub 2-3 m high, with numerous ascending stems spreading into broad thickets, and covered below with ashy gray bark, and stout slightly zigzag glabrous branchlets green tinged with red when they first appear, soon becoming bright chestnut-brown and lustrous and marked by large pale lenticels, and armed with many stout nearly straight chestnut-brown shining spines 4-6 cm long and usually pointing toward the base of the branch.

Niagara Falls, J. Dunbar and C. S. Sargent (*26, type), September 16, 1904, J. Dunbar, May 28, 1905.

***Crataegus amoena* n. sp.**

Leaves ovate, acute or acuminate, concave-cuneate or rounded at the entire base, finely doubly serrate above, with straight or incurved glandular teeth, and divided above the middle into 2 or 3 pairs of broad acute lobes; slightly tinged with red when they unfold, about half grown when the flowers open at the end of May and then thin, smooth and light yellow-green above and pale below, and at maturity thin but firm in texture, dark bluish green on the upper surface, pale on the lower surface, 4-6 cm long, 3.5-5 cm wide, with slender mid-ribs often tinged with rose in the autumn, and 3 or 4 pairs of obscure primary veins; petioles slender, slightly wing-margined at the apex, deeply grooved, sparingly glandular while young, 1.5-2.5 cm in length; stipules linear, glandular, fading brown, caducous; leaves on vigorous shoots rounded or cuneate at the broad base, 6-7 cm long and 5-6 cm wide. Flowers 1.2-1.4 cm in diameter, on short slender pedicels, in compact most 4-6 flowered corymbs; calyx-tube broadly obconic, the lobes gradually narrowed from wide bases, short, acuminate, generally entire; stamens 20; anthers creamy white suffused with pink; styles 3-5. Fruit ripening from the middle to the end of October, on stout erect pedicels, in few-fruited clusters, subglobose to short-oblong, dark red, pruinose, 1-1.2 cm in diameter; calyx prominent, with a broad deep cavity, and spreading lobes dark red on the upper side toward the base; flesh thin, hard, greenish yellow; nutlets 3-5, gradually narrowed and rounded at the ends, ridged on the back, with a high narrow rounded ridge, dark colored, about 7 mm long, and 5 mm wide.

A shrub 3-4 m high, with ascending and spreading stems covered below with dark red bark, and slender slightly zigzag branchlets olive-green deeply tinged with red when they first appear, becoming bright chestnut-brown and very lustrous and marked by occasional large dark lenticels in their first season and dull gray the following year, and armed with numerous slender nearly straight purple spines 4-6 cm long, and persistent and branched on old stems.

Niagara Falls, J. Dunbar and C. S. Sargent (*21, type), September 16, 1904, J. Dunbar, May 28, 1905.

***Crataegus clintoniana* n. sp.**

Leaves ovate, acuminate, cuneate or rounded at the entire base, finely and often doubly serrate above, with straight glandular teeth, and divided into 4 or 5 pairs of narrow acuminate lateral lobes; when they unfold tinged with red, sparingly villose on the upper surface and villose below along the midribs and veins and furnished with axillary tufts of matted pale hairs, nearly half grown when the flowers open about the 20th of May and then thin, light yellow-green, still sparingly hairy principally along the under side of the midribs and veins and pale bluish green below, and at maturity thin, yellow-green, smooth and glabrous on the upper surface and nearly glabrous on the lower surface, 4-5 cm long and 3.5-4 cm wide, with slender midribs, and usually 4 pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, glabrous, sparingly glandular while young, 1-1.5 cm in length; leaves on vigorous shoots abruptly cuneate or rounded at the broad base, coarsely serrate, deeply lobed, often 6-7 cm long and broad, with stout broadly winged glandular petioles 2.5-3 cm in length. Flowers 2 cm in diameter, on slender villose pedicels, in compact mostly 5- or 6-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, nearly entire, glabrous, reflexed after anthesis; stamens 20; anthers bright red; styles 3-5, generally 5, surrounded at the base by a broad ring of pale hairs. Fruit ripening early in October, on stout reddish pedicels, in few-fruited erect clusters, subglobose but often rather broader than high, distinctly angled, orange-red, lustrous, marked by numerous small pale dots, 1.2-1.4 cm in diameter; calyx prominent, with a short tube, a broad deep cavity, and small spreading or reflexed lobes persistent on the ripe fruit; flesh thick, yellowish green, dry and mealy; nutlets usually 5, narrowed and rounded at the ends, slightly grooved on the back, 6-7 mm long, and 4-5 mm wide.

A narrow shrub thin in habit, 5-6 m high, with many small stems covered with dark gray scaly bark, spreading and ascending branches, and slender nearly straight branchlets glabrous and orange-green slightly tinged with red when they first appear, becoming red-brown and lustrous during their first season and dull gray-brown the following year, and armed with numerous, thin, straight, light chestnut-brown shining, ultimately dull gray spines 4-5 cm in length, persistent, very numerous and becoming branched on the old stems.

Low wet woods, Buffalo; J. Dunbar (* 8, type), May 21 and September 29, 1903, September 26, 1905. Not common.

This handsome and distinct species is named in memory of George W. Clinton (1807-85), a distinguished judge of the Supreme Court of the city of Buffalo and a critical student of the plants growing in the neighborhood of that city.

***Crataegus oblita* n. sp.**

Leaves oblong-ovate to nearly triangular, acuminate, rounded, subcordate or abruptly concave-cuneate at the broad entire or glandular base, finely doubly serrate above, with straight glandular teeth, and divided often only above the middle into 4 or 5 pairs of wide acuminate spreading lobes; about one third grown when the flowers open the 25th of May and then membranaceous, yellow-green, roughened above by short white hairs and pale and glabrous below, and at maturity thin but firm in texture, dull blue-green, smooth and lustrous on the upper surface, pale bluish green on the lower surface, 5-6.5 cm long and 4.5-5 cm wide, with thin yellow midribs, and slender primary veins extending obliquely to the points of the lobes; petioles very slender, slightly wing-margined at the apex, sparingly villose while young on the upper side, soon glabrous, 3-4 cm in length; leaves on vigorous shoots subcoriaceous, truncate or rounded at the base, more coarsely serrate and more deeply lobed, often 5.5-6 cm long and wide. Flowers 1.5-1.6 cm in diameter, on long slender glabrous pedicels, in lax mostly 4-6-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from broad bases, wide, acuminate, entire or occasionally slightly toothed near the middle, glabrous, reflexed after anthesis; stamens 20; anthers rose color; styles 4 or 5, surrounded at the base by a narrow ring of pale hairs. Fruit ripening the end of September, on slender drooping pedicels, in few-fruited clusters, obovate, full and rounded at the apex, slightly narrowed to the rounded base, crimson, pruinose, finally becoming lustrous, marked by large pale

dots, 9-11 mm long and 9-10 mm in diameter; calyx enlarged and prominent, with a broad deep cavity, and spreading and appressed usually persistent slightly serrate lobes dark red on the upper side below the middle; flesh thin, yellow-green, dry and mealy; nutlets 4 or 5, thin and compressed at the rounded ends, rounded and slightly grooved or irregularly ridged on the back, 6-7 mm long, and 4-5 mm wide.

A shrub 4-5 m high, with small ascending stems covered with pale gray bark, spreading branches and slender slightly zigzag glabrous branchlets, dark reddish brown and marked by pale lenticels when they first appear, becoming dark chestnut-brown and very lustrous in their first season and dull red-brown the following year, and armed with slender straight slightly curved dull chestnut-brown spines 3-5 cm long.

Borders of thickets in low moist soil, Buffalo, J. Dunbar (* 16, type), June 1, 1904, May 28, 1906, J. Dunbar and C. S. Sargent, September 24, 1904.

Crataegus cognata Sargent

Rhodora V. 58 (1903).

Buffalo, J. Dunbar (* G), October 1901, May 26 and October 6, 1902, May 21 and September 29, 1903; (* 23), September 30, 1904, June 12, 1905; (* 38), June 12 and September 26, 1905; Niagara Falls, J. Dunbar and C. S. Sargent (* 8), September 16, 1904, J. Dunbar, June 12, 1905; (* 15), J. Dunbar and C. S. Sargent, September 16, 1904, J. Dunbar, May 26, 1905; near Hemlock lake, Livingston co., Henry T. Brown (* 15 and 26), May and October 1906; also southern and western New England and eastern New York.

Crataegus formosa Sargent

Rochester Acad. Sci. Proc. IV. 101 (1903).

Buffalo, J. Dunbar, October 6, 1902, September 26, 1905, May 28, 1906, Niagara Falls, J. Dunbar (* 1), October 7, 1902, May 22, 1903; also at Rochester, New York.

Crataegus leiophylla Sargent

Rochester Acad. Sci. Proc. IV. 99 (1903).

Buffalo, J. Dunbar, September 26, 1905, May 25, 1906; also at Rochester, New York.

The anthers in this species were first described as pale yellow; further observations show that they are slightly tinged with pink.

***Crataegus pulchra* n. sp.**

Glabrous. Leaves ovate to oval, acuminate, rounded or occasionally cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and divided very slightly above the middle into 3 or 4 pairs of short broad acuminate lobes; deeply tinged with red when they unfold, more than half grown when the flowers open at the end of May and then thin, yellow-green above and paler below, and at maturity thin, yellow-green, 4.5-5.5 cm long and broad, with slender yellow midribs, and obscure primary veins; petioles slender, slightly wing-margined sometimes nearly to the middle, glandular with minute dark glands, 2-2.5 cm in length. Flowers about 1.8 cm in diameter, on slender pedicels, in compact mostly 6-8-flowered corymbs, with linear acuminate glandular bracts and bractlets fading rose color; calyx-tube broadly obconic, the lobes slender, acuminate, entire or sparingly glandular toward the apex, reflexed after anthesis; stamens 10; anthers maroon; styles 2-4. Fruit ripening the middle of September, on short stout pedicels, in drooping 2-3-fruited clusters, short-oblong, full and rounded at the ends, cherry-red, pruinose, marked by small pale dots, 1-1.2 cm in diameter; calyx prominent, with a broad shallow cavity, and widespreading or closely appressed usually persistent lobes dark red on the upper side; flesh thin, yellow, dry or mealy; nutlets 2-4, narrowed and acute at the ends or rounded at the base, ridged on the back, with a narrow rounded ridge, light colored, about 8 mm long, and 5 mm wide.

A shrub 1-2.5 m high, with small stems spreading into thickets, and slender nearly straight branchlets orange-green tinged with red when they first appear, becoming chestnut-brown, lustrous and marked by small pale lenticels in their first season, and dark red-brown the following year, and armed with thin nearly straight purple ultimately gray-brown spines 3-5 cm long.

Niagara Falls, J. Dunbar and C. S. Sargent (*25, type), September 16, 1904, J. Dunbar, May 28, 1905; Buffalo, (*11) J. Dunbar, September 30, 1904, and May 28, 1905; (*23), J. Dunbar and C. S. Sargent, September 16, 1904, J. Dunbar, May 28, 1905.

***Crataegus radiata* n. sp.**

Glabrous. Leaves ovate, acuminate, cuneate or rounded at the entire base, coarsely doubly serrate above, with straight gland-tipped teeth, and divided into 3 or 4 pairs of narrow acuminate spreading lateral lobes; nearly half grown when the flowers open about the

20th of May and then thin, smooth and yellow-green above and pale blue-green below, and at maturity thin but firm, dark dull blue-green on the upper surface and pale on the lower surface, 5-7 cm long and 4-5 cm wide, with prominent yellow midribs, and slender primary veins arching obliquely to the points of the lobes; petioles slender, wing-margined to below the middle, glandular, with persistent glands, often rose color in the autumn, 1.5-2 cm in length; leaves on vigorous shoots subcoriaceous, rounded at the broad base, more coarsely serrate and more deeply lobed and sometimes 8-9 cm long and broad, with stout broadly winged conspicuously glandular petioles. Flowers 1.8-2 cm in diameter, on slender elongated pedicels, in loose usually 5- or 6-flowered long-branched corymbs; calyx-tube narrowly obconic, the lobes slender, acuminate, entire; stamens 9 or 10; anthers dark red; styles usually 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening about the 1st of October, on stout reddish pedicels, in few-fruited drooping clusters, short-oblong, full and rounded at the ends, crimson, lustrous, marked by many small dark dots, 1.5-1.7 cm in diameter; calyx little enlarged, with a narrow deep cavity, and closely appressed lobes persistent on the ripe fruit; flesh thick, yellow, dry and mealy; nutlets usually 4, narrowed at the ends, rounded at the base, ridged on the back, with a broad grooved ridge, light colored, 6-7 mm long, and 4-5 mm wide.

A shrub 4-6 m high, with numerous small stems covered with dark gray scaly bark, small spreading branches, and slender zigzag branchlets dark orange-green when they first appear, becoming bright chestnut-brown and very lustrous in their first season and dull red-brown the following year, and armed with many slender slightly curved purple shining spines 3.5-4 cm long, persistent and very numerous on old stems.

Buffalo, J. Dunbar (* 3, type), October 6, 1902, May 21 and September 29, 1903, J. Dunbar and C. S. Sargent, September 24, 1904.

***Crataegus aridula* n. sp.**

Glabrous. Leaves ovate, acuminate, cuneate or concave-cuneate at the entire base, sharply doubly serrate above, with straight glandular teeth, and divided into 5 or 6 pairs of narrow acuminate spreading lobes; nearly full grown when the flowers open during the first week of June and then thin, dark yellow-green, smooth above and pale below, and at maturity thin, dark bluish green on the upper surface, pale on the lower surface, 4-5 cm long and

3.5-4.5 wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, glandular, with minute scattered glands, 2-3 cm in length; leaves on vigorous shoots deltoid to rhombic, thin, coarsely serrate, often 6-7 cm long and broad, with slender wing-margined conspicuously glandular petioles. Flowers on long slender pedicels, in 5-7-flowered compact corymbs, with linear to linear-obovate glandular bracts and bractlets fading rose color; calyx-tube broadly obconic, the lobes gradually narrowed from the base, slender, acuminate, entire or occasionally sparingly dentate below the middle; stamens 10; anthers red; styles 2 or 3. Fruit remaining hard and dry in the autumn, obovate, dark red, marked by many large pale dots, pruinose, about 1 cm long and 8-9 mm wide; calyx prominent, with a long tube, a deep narrow cavity, and spreading persistent lobes; flesh thin, yellowish green; nutlets 2 or 3, rounded at the base, acute at the apex, ridged on the back, with a low rounded ridge, light colored, 7-8 mm long, and 4-5 mm wide.

A shrub, with slender nearly straight branchlets, olive-green tinged with red when they first appear, becoming light chestnut-brown and lustrous in their first season and ultimately dark gray-brown, and armed with straight slender dark purplish spines 2.5-3 cm in length.

Niagara Falls, J. Dunbar (* 3, type), October 7, 1902, and June 1, 1904.

***Crataegus congestiflora* n. sp.**

Leaves ovate, acuminate, rounded or abruptly cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and slightly divided into 5 or 6 pairs of broad spreading acuminate lateral lobes; more than half grown when the flowers open during the last week of May and then membranaceous, light yellow-green and covered above by short white hairs and pale bluish green and glabrous below, and at maturity thin, dark blue-green, dull and glabrous on the upper surface and paler blue-green on the lower surface, 4-6 cm long and 3-4.5 cm wide, with thin yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly glandular, 1.5-2.5 cm in length; leaves on vigorous shoots short-pointed at the apex, rounded at the broad base, more coarsely serrate and more deeply lobed, about 6-7 cm long and 5-6 cm wide. Flowers 1.4-1.5 cm in diameter, on slender glabrous pedicels, in very compact mostly 4-6-flowered corymbs;

calyx-tube narrowly obconic, glabrous, the lobes wide, acuminate, entire or occasionally irregularly toothed toward the apex, glabrous, bright red above the middle, reflexed after anthesis; stamens 5-8, usually 5; anthers dark rose color; styles 3 or 4, surrounded at the base by a wide ring of pale tomentum. Fruit ripening the end of October, on slender reddish pedicels, in 4- or 5-fruited spreading clusters, somewhat obovate, full and rounded at the apex, slightly narrowed and sometimes decurrent on the pedicel at the base, marked by many pale dots, crimson, pruinose, 1-1.2 cm long and 9-11 mm wide; calyx little enlarged, without a tube, with a narrow shallow cavity, and spreading persistent lobes often serrate toward the apex and dark red on the upper side; flesh thin, yellow, dry and mealy; nutlets 2 or 3, narrowed and rounded at the ends or acute at the apex, ridged on the back, with a broad grooved ridge, 6-7 mm long, and 4-5 mm wide

A shrub 3-4 m high, with small stems covered with dark gray bark, ascending and spreading branches, and very slender zigzag glabrous branchlets light green, slightly tinged with red when they first appear, becoming bright chestnut-brown and very lustrous in their first season and dull reddish brown the following year, and armed with numerous thin slightly curved light brown shining spines, becoming purple and ultimately gray, and 2.5-3 cm long.

Buffalo, J. Dunbar (*19, type), September 30, 1904, May 27, 1905; (*31), September 30, 1904; (*44), September 26, 1905.

***Crataegus plana* n. sp.**

Leaves oblong-obovate, acuminate, rounded or rarely cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and slightly divided above the middle into 3 or 4 pairs of small spreading acuminate lobes; tinged with red and sparingly villose on the upper surface and in the axils of the veins below when they unfold, almost fully grown and nearly glabrous when the flowers open about the 20th of May and then thin, light yellow-green and smooth above and bluish green below, and at maturity thin, glabrous, dark green and somewhat lustrous on the upper surface and pale blue-green on the lower surface, 4-5 cm long and 3-4 cm wide, with slender yellow midribs, and thin primary veins extending obliquely to the points of the lobes; petioles slender, wing-margined often to the middle, slightly glandular while young, 1.5-2 cm in length; leaves on vigorous shoots subcoriaceous, broadly ovate to suborbicular, rounded or cordate at the base, more

coarsely serrate and more deeply lobed, and sometimes 6-7 cm wide, with stout broadly winged petioles glandular throughout the season. Flowers 2 cm in diameter, on slender glabrous pedicels, in usually 5-7-flowered corymbs, with linear glandular bracts and bractlets fading rose color; stamens 10, filaments persistent on the ripe fruit; anthers pale pink; styles 3-5, surrounded at the base by a broad ring of pale hairs. Fruit ripening from the first to the middle of October, on slender pedicels, in few-fruited erect clusters, short-oblong, somewhat rounded at the base, bright green when fully grown, crimson at maturity, pruinose, marked by many small pale dots; calyx prominent, without a tube, with a broad deep cavity, and widespread persistent lobes dark red on the upper side below the middle; flesh thin, yellow-green, hard, dry and mealy; nutlets 3-5, rounded at the ends, rounded and slightly grooved on the back, light colored, 5-6 mm long, and about 4 mm wide.

A shrub 3-4 m high and broad, with several stout erect stems covered with dark scaly bark, small spreading and ascending branches, and very slender glabrous branchlets, light chestnut-brown and lustrous in their first season, dark dull reddish brown the following year, and armed with numerous slender nearly straight chestnut-brown and shining, ultimately dark gray spines 3-4 cm long.

Buffalo, J. Dunbar (* 4, type), October 6, 1902, May 21, 1903; near Hemlock lake, Livingston co., H. T. Brown (* 3), May and October 1906.

***Crataegus maineana* Sargent**

Rochester Acad. Sci. Proc. IV. 106 (1903).

Buffalo, J. Dunbar (* D), September 25, 1901, May 28, 1906; Niagara Falls, J. Dunbar, September 28, 1905, May 28, 1906; also near Rochester, New York.

***Crataegus placiva* n. sp.**

Leaves ovate, acuminate, rounded, truncate or abruptly concave-cuneate at the broad entire or glandular base, finely doubly serrate above, with straight glandular teeth, and divided into 2 or 3 pairs of short broad acuminate lateral lobes; deeply tinged with red when they unfold, nearly fully grown when the flowers open at the end of May, and then thin, yellow-green and roughened above by short white hairs and pale and slightly hairy in the axils of the veins below, and at maturity thick, glabrous, smooth, dark blue-

green on the upper surface, pale on the lower surface, and 4-5 cm long and broad, with slender midribs and 3 or 4 pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, glandular throughout the season, often tinged with red in the autumn, 2-3 cm in length; stipules linear, glandular, fading brown, caducous; leaves on vigorous shoots subcoriaceous, truncate at the base, coarsely serrate, more deeply lobed and often 7-8 cm long and wide. Flowers 2 cm in diameter, on elongated slender glabrous pedicels, in compact usually 5- or 6-flowered corymbs, with linear to linear-obovate glandular bracts and bractlets; calyx-tube broadly obconic, glabrous, the lobes short, slender, acuminate, glabrous, entire; stamens 10; filaments persistent on the ripe fruit; anthers purplish red; styles 3 or 4, surrounded at the base by a broad ring of long matted white hairs. Fruit ripening from the first to the middle of October, short-oblong, full and rounded at the ends or obovate and slightly narrowed at the base, bright orange-red, pruinose, marked by small pale dots, 1-1.2 cm in diameter; calyx prominent, without a tube, with a broad shallow cavity, and widespreading persistent lobes dark red on the upper side below the middle; flesh thin, yellow, dry and mealy; nutlets 3 or 4, narrow and rounded at the ends, slightly ridged on the back, with a low rounded ridge, about 7 mm long, and 4-5 mm wide.

A shrub sometimes 5 m high, with ascending stems covered with dark gray scaly bark, spreading branches, and slender zigzag glabrous branchlets dark orange-green more or less deeply tinged with red when they first appear, becoming dull chestnut-brown and marked by small pale lenticels in their first season and dull reddish brown the following year, and armed with slender slightly curved shining spines 5-6 cm long, persistent and very numerous on old stems and branches.

Buffalo, J. Dunbar (* 22, type), September 30, 1904, May 28, 1905; (* 27), September 30, 1904, May 28, 1906.

***Crataegus tortuosa* n. sp.**

Leaves oblong-ovate, abruptly cuneate or rarely rounded at the entire base, finely doubly serrate above, with straight or incurved glandular teeth, and slightly divided into 4 or 5 pairs of broad acuminate spreading lobes, about half grown when the flowers open at the end of May and then membranaceous, yellow-green, slightly roughened above by short white hairs and glabrous below, and at maturity thick, blue-green, smooth and glabrous on the upper sur-

face, 5-6.5 cm long and 4.5-5 cm wide, with stout yellow midribs sometimes tinged with rose color in the autumn, and thin remote primary veins extending to the points of the lobes; petioles stout, wing-margined at the apex, sparingly glandular early in the season, tinged with rose color in the autumn, 2-4 cm in length; leaves on vigorous shoots usually broader and rounded or cordate at the base, more deeply lobed and sometimes 6-7 cm long and wide. Flowers on short slender glabrous pedicels, in compact 3-8, usually 5-flowered corymbs, with small linear rose colored bracts and bractlets; calyx-tube narrowly obconic, the lobes short and broad, minutely serrate near the middle, glabrous, red and glandular at the acuminate apex, reflexed after anthesis; stamens usually 5; anthers purplish red; styles 2-4, surrounded at the base by a broad ring of long pale hairs. Fruit ripening the end of September, on stout drooping reddish pedicels, in few-fruited clusters, obovate, full and rounded at the apex, abruptly narrowed at the base, bright orange-red, pruinose, marked by numerous pale dots, lustrous, 1-1.2 cm long, and 8-10 mm wide; calyx-tube little enlarged, with a broad shallow cavity, and narrow spreading lobes dark red on the upper side below the middle, their tips incurved or more often deciduous from the ripe fruit; nutlets 2 or 3, narrow and rounded at the ends, prominently ridged on the back, with a broad deeply grooved ridge, light colored, 7-8 mm long, and 4-5 mm wide.

A shrub sometimes 5-6 m high, with stout stems, very tortuous horizontal or ascending branches, and slender slightly zigzag glabrous branchlets, dark orange-green when they first appear, becoming bright chestnut-brown and marked by dark lenticels in their first season and dull reddish brown the following year, and armed with numerous stout nearly straight bright chestnut-brown shining ultimately dull gray spines 2-3 cm long.

Buffalo, J. Dunbar, (* 25, type), September 30, 1904, May 28 and September 26, 1905; J. Dunbar and C. S. Sargent (* 29), September 30, 1904; (* 17), September 24, 1904. J. Dunbar, May 28, 1905.

***Crataegus xanthophylla* n. sp.**

Leaves broadly ovate, acuminate, rounded or cuneate at the entire or glandular base, sharply doubly serrate, with straight glandular teeth; and divided above the middle into 3 or 4 small acuminate lobes; nearly half grown when the flowers open at the end of May and then thin, light yellow-green and roughened above by short

white hairs and pale blue-green and glabrous below, and at maturity thick and firm to subcoriaceous, glabrous, smooth and dark yellow-green on the upper surface, pale yellow-green on the lower surface, 6-8 cm long and 5-7 cm wide, with stout yellow midribs and 4 or 5 pairs of slender primary veins; petioles stout, slightly wing-margined at the apex, glandular, with minute persistent glands, often rose color in the autumn, 2-3.5 cm in length. Flowers 1.5 cm in diameter, on slender glabrous pedicels, in compact usually 5-7-flowered corymbs; calyx-tube broadly obconic, glabrous, the lobes short and broad, acuminate, glabrous, coarsely glandular serrate above the middle, reflexed after anthesis; stamens 10; anthers red; styles 3 or 4, surrounded at the base by a broad ring of pale tomentum. Fruit ripening early in October, on stout drooping dark red glabrous pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, orange-red, slightly pruinose, marked by small pale dots, 1-1.2 cm long; calyx little enlarged, with a broad shallow cavity, and spreading persistent glabrous lobes dark red on the upper side below the middle; nutlets 3 or 4, acute at the ends, ridged on the back, with a narrow ridge, dark colored, 7-8 mm long, and about 4 mm wide.

A shrub 5-6 m high, with numerous slender spreading stems covered with pale gray bark, small ascending branches, and slender slightly zigzag glabrous branchlets, dark orange-green and marked by small pale lenticels when they first appear, becoming bright red-brown the following year, and armed with a few slender shining spines 2.5-3 cm long.

Buffalo, J. Dunbar (*1, type), October 6, 1902, May 26, 1906.

Crataegus implicata n. sp.

Leaves ovate to oval, acuminate and short-pointed at the apex, rounded and cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of small acuminate spreading lobes; nearly fully grown when the flowers open at the end of May and then yellow-green and slightly roughened above by scattered white hairs, and at maturity membranaceous, dark bluish green and smooth on the upper surface, pale blue-green on the lower surface, 3.5-4.5 cm long and 3-4 cm wide, with thin midribs, and slender primary veins; petioles very slender, sparingly glandular through the season, 1-2.5 cm in length; stipules linear to linear-falcate, glandular-serrate, fading brown, persistent; leaves on vigorous shoots subcoriaceous, broadly ovate,

more deeply lobed, often 5 cm long and wide, with foliaceous lunate coarsely serrate persistent stipules. Flowers 1.3–1.5 cm in diameter, on slender glabrous pedicels, in very compact mostly 5- or 6-flowered corymbs, with linear glandular bracts and bractlets; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, nearly entire, red and glandular at the apex, reflexed after anthesis; stamens 5–8; anthers dark rose color; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening at the end of September, on short dark red pedicels, in usually 1–3-fruited drooping clusters, subglobose to ovate, pruinose, marked by many small pale dots, 1–3 cm long, 1–1.1 cm in diameter; calyx prominent, with a short tube, a small deep cavity, and spreading minutely serrate persistent lobes dark red on the upper side below the middle; flesh thick, yellow, dry and mealy; nutlets 3 or 4, narrowed and acute at the ends or rounded at the base, rounded or slightly ridged on the back, with a low ridge, light colored, 6–7 mm long, and 4 mm wide.

A thin intricately branched shrub sometimes 4 m high, with irregularly spreading stems covered at the base with dark gray bark, and slender glabrous branchlets dark orange-green tinged with red when they first appear, becoming in their first season bright chestnut-brown, lustrous and marked by numerous dark lenticels, dull gray-brown the following year, and armed with many straight purplish shining ultimately dull gray-brown spines 4–6 cm long and very numerous and branched on old stems.

Buffalo, J. Dunbar (* 39, type), May 28 and September 26, 1905.

***Crataegus promissa* n. sp.**

Leaves oblong-ovate, acuminate, gradually narrowed and concave-cuneate at the entire or glandular base, sharply doubly serrate above, with straight or incurved glandular teeth, and deeply divided into 4–6 pairs of slender acuminate lobes; about one third grown when the flowers open the first of June and then thin, yellow-green and roughened above by short white hairs, and at maturity thin, glabrous, dark blue-green and smooth on the upper surface and pale blue-green on the lower surface, 5–5.8 cm long and 4–7 cm wide, with slender yellow midribs, and thin primary veins arching to the points of the lobes; petioles slender, wing-margined at the apex, sparingly glandular through the season, 4–4.5 cm in length; stipules linear-obovate, glandular, fading brown, caducous; leaves on vigorous shoots thick, cuneate at the base, coarsely serrate, deeply lobed,

sometimes 8-9 cm long and 7-8 cm wide, with broadly winged petioles and foliaceous lunate coarsely serrate persistent stipules. Flowers 1.6 cm in diameter, on slender elongated glabrous pedicels, in broad lax many-flowered corymbs, with linear to oblong-obovate glandular caducous bracts and bractlets; calyx-tube narrowly obconic, glabrous, the lobes long, narrow, acuminate, entire or slightly dentate below the middle, glabrous, reflexed after anthesis; stamens 5-7; anthers pink; styles 3 or 4, surrounded at the base by a broad ring of long white hairs. Fruit ripening at the end of September, on long slender drooping pedicels, in many-fruited clusters, oblong-obovate, tapering at the long base, crimson, lustrous, 1-1.2 cm long and 7-8 mm wide; calyx little enlarged, with a small shallow cavity, and reflexed often closely appressed elongated narrow lobes; flesh thin, dry and mealy; nutlets 3 or 4, rounded at the base, acute at the apex, only slightly ridged on the back, 8-9 mm long, and about 4 mm wide.

A shrub 3-4 m high, with numerous stems covered with dark gray scaly bark, ascending branches, and slender zigzag glabrous branchlets bright orange-green more or less tinged with purple when they first appear, becoming light chestnut-brown and marked by large pale lenticels in their first season and pale gray-brown the following year, and armed with slender slightly curved light chestnut-brown shining spines 4-5 cm long, often pointing to the base of the branch, and compound and persistent on old stems.

Niagara Falls, J. Dunbar, (* 4, type), May 21 and September, 1903, June 1, 1904; J. Dunbar and C. S. Sargent (* 19), September 16, 1904, J. Dunbar, May 28, 1905, J. Dunbar (* 30), September 27, 1905, May 28, 1906.

***Crataegus strigosa* n. sp.**

Leaves ovate, acuminate and long pointed at the apex, cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and divided into 5 or 6 pairs of small acuminate spreading lateral lobes; more than half grown when the flowers open at the end of May and then membranaceous, yellow-green and roughened above by short rigid white hairs and pale and glabrous below, and at maturity thin, yellow-green and scabrate on the upper surface and light yellow-green on the lower surface, 4-5 cm long and 3.5-4 cm wide, with stout midribs, and 5 or 6 pairs of prominent primary veins; petioles slender, slightly wing-margined at the apex, glandular throughout the season, 2-2.5 cm in length. Flowers

1.5 cm in diameter, on slender glabrous pedicels, in 5-8, usually 5-6-flowered compact corymbs, the lowest peduncle generally from the axis of an upper leaf; calyx-tube narrowly obconic, glabrous, the lobes small, acuminate, entire or slightly glandular, glabrous, reflexed after anthesis; stamens 7-10; anthers purple; styles 3-5, surrounded at the base by a narrow ring of pale hairs. Fruit ripening early in October, on stout reddish drooping or spreading pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, scarlet, lustrous, marked by occasional dark dots, 1.3-1.4 cm long, 1-1.1 cm in diameter; calyx little enlarged, without a tube, with a narrow deep cavity, and small spreading or closely appressed persistent lobes, dark red on the upper side below the middle; flesh thin, yellow, dry and mealy; nutlets 3-5, narrowed and rounded at the ends or acute at the apex, ridged on the back, with a broad rounded or grooved ridge, light colored, 6-7 mm long, and about 4 mm wide.

A shrub 3-4 m high, with stout stems covered with dark scaly bark, ascending branches, and slender somewhat zigzag glabrous branchlets dark olive-green tinged with red when they first appear, becoming light chestnut-brown, lustrous and marked by many small dark lenticels in their first season, and armed with slender slightly curved light chestnut-brown shining spines 3-6 cm long.

Buffalo, J. Dunbar (* 20, type), September 30, 1904 and May 28, 1905.

***Crataegus barryana* n. sp.**

Leaves broadly ovate, rounded or abruptly cuneate at the wide base, sharply doubly serrate, with straight glandular teeth, and very slightly divided into 4-6 pairs of small acuminate spreading lobes; nearly half grown when the flowers open about the 20th of May and then thin, dark yellow-green and roughened above by short white hairs and pale and glabrous below, and at maturity thin but firm in texture, dull yellow-green, scabrate and lustrous on the upper surface, glaucous on the lower surface, 6-8 cm long and 5-7 cm wide, with slender midribs, and thin primary veins extending obliquely to the points of the lobes; turning yellow in the autumn; petioles slender, narrowly wing-margined at the apex, slightly villose on the upper side while young, becoming glabrous, sparingly glandular, with persistent glands, 3-5 cm in length; leaves on vigorous shoots rounded or slightly cordate at the broad base, more coarsely serrate and more deeply lobed, often 8-9 cm long and broad. Flowers 2 cm in diameter, on stout glabrous pedicels, in compact mostly 7-10-flowered corymbs; calyx-tube narrowly ob-

conic, glabrous, the lobes slender, acuminate, entire or sparingly dentate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 7-10; anthers purple; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the middle of October, on stout erect or spreading reddish pedicels, in few-fruited clusters, obovate, full and rounded at the apex, abruptly narrowed at the rounded base, crimson, marked by small pale dots, pruinose, about 1.8 cm long and 1.5 cm wide; calyx little enlarged, with a narrow shallow cavity, and spreading persistent lobes villose above and dark red on the upper side below the middle; flesh thick, dark yellow, dry and mealy; nutlets usually 3, narrowed and rounded at the ends, prominently ridged on the back, with a broad grooved ridge, 7-8 mm long, and about 5 mm wide.

A shrub 4-5 m high, with small spreading or ascending branches covered with dark scaly bark and forming an open irregular head, and slender glabrous branchlets dark orange-brown and marked by numerous pale lenticels when they first appear, becoming dull red-brown in their first season and light gray-brown the following year, and armed with slender slightly curved light red-brown spines 3.5-4 cm long, long persistent and often becoming branched on old stems.

Rochester, common in moist heavy soil, J. Dunbar (* 37, type), October 14, 1902, May 20, 1903.

At the suggestion of Mr Dunbar this species is named for William C. Barry of Rochester, whose practical knowledge and business ability have been powerful in advancing horticulture in America.

***Crataegus foliata* n. sp.**

Leaves crowded, ovate-oblong, acuminate, rounded or concave-cuneate at the base, coarsely doubly serrate, and slightly divided into 4 or 5 pairs of small acuminate spreading lobes; more than half grown when the flowers open at the end of May and then membranaceous, yellow-green, slightly roughened above by short white hairs and glabrous below, and at maturity thin but firm in texture, glabrous, smooth, yellow-green on the upper surface and paler on the lower surface, 5-7 cm long and 4-5 cm wide, with stout yellow midribs and slender primary veins; petioles stout, slightly wing-margined at the apex, glandular while young, often rose color in the autumn, 2.5-3 cm in length; leaves on vigorous shoots rounded or cordate at the broad base, coarsely serrate, more deeply lobed, 6-7 cm long

and broad, with short stout conspicuously glandular petioles. Flowers 1.5–1.6 cm in diameter, on long slender glabrous pedicels, in broad lax usually 8–12-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes stout, broad, acuminate, slightly serrate usually only above the middle, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 7–10; anthers dark rose color; styles usually 3. Fruit ripening early in October, on long slender red drooping pedicels, in few-fruited clusters, obovate, crimson, lustrous, marked by numerous small pale dots, 1–1.2 cm long and 8–10 mm wide; calyx prominent, with a narrow deep cavity, and spreading or slightly appressed persistent lobes dark red on the upper side below the middle; flesh thin, yellow, dry and mealy; nutlets 3, narrowed and acute at the ends or rounded at the base, prominently ridged on the back, with a broad doubly grooved ridge, dark colored, 6–7 mm long, and about 4 mm wide.

A leafy shrub 3–4 m high, with ascending tortuous stems covered with dark scaly bark, stout glabrous branchlets purple and marked by large pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season and light reddish brown the following year, and armed with stout straight or slightly curved bright chestnut-brown and shining ultimately dull gray-brown spines 1.5–4 cm. long.

Niagara Falls, J. Dunbar and C. S. Sargent (✱ 20, type, and 27), September 16, 1904. J. Dunbar, May 28, 1905.

***Crataegus cruda* n. sp.**

Leaves ovate, acuminate, rounded or abruptly or gradually narrowed and cuneate at the entire base, sharply doubly serrate above, with straight glandular teeth, and slightly divided often only above the middle into 4 or 5 pairs of small acuminate spreading lobes; nearly half grown when the flowers open during the last week of May and then membranaceous, yellow-green and scabrate above and paler and glabrous below, and at maturity thin but firm in texture, yellow-green, smooth, glabrous, 5–6 cm long and 4–4.5 cm wide; petioles very slender, slightly wing-margined at the apex, glabrous, 2.5–3 cm in length; leaves on vigorous shoots coarsely serrate, more deeply lobed, gradually narrowed below into broad-winged petioles, often 9–10 cm long and 6–7 cm wide. Flowers 1.2–1.4 cm in diameter, on very slender glabrous pedicels, in long-branched lax usually 7–10-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate, usually entire,

glabrous, reflexed after anthesis; stamens 5-8; anthers pale pink; styles 3 or 4, surrounded at the base by a broad ring of pale tomentum. Fruit ripening at the end of September, on slender drooping red pedicels, in few-fruited clusters, obovate, scarlet, lustrous, marked by small pale dots, 1.2-1.5 cm long and about 1 cm wide; calyx little enlarged, with a wide shallow cavity, and spreading and appressed persistent lobes dark red on the upper side below the middle; flesh thick, yellow, sweet and juicy; nutlets 3 or 4, acute at the ends, slightly ridged or grooved on the back, about 7 mm long, and 3 mm wide.

A shrub 3-4 m high, with dark gray stems, and stout zigzag glabrous branchlets dark orange-green when they first appear, becoming dark chestnut-brown or orange-brown and marked with numerous small dark lenticels in their first season and dull reddish brown the following year, and armed with very stout straight or slightly curved light red-brown shining spines 4-6 cm long and branched and persistent on old stems.

Niagara Falls, J. Dunbar (* 31, type), September 27, 1905, and May 28, 1906.

***Crataegus inusitula* n. sp.**

Leaves broadly ovate, acuminate and long pointed at the apex, rounded or abruptly concave-cuneate at the broad entire base, coarsely doubly serrate above, with straight glandular teeth, and divided usually only above the middle into 3 or 4 pairs of short broad acuminate lobes; tinged with red when they unfold, not more than one third grown when the flowers open about the first of June and then bluish green and roughened above by short white hairs and pale and slightly villose in the axils of the veins below, and at maturity subcoriaceous, dark blue-green, smooth or scabrate on the upper surface, pale blue-green and glabrous on the lower surface, 4-7 cm long and 2.5-5 cm wide, with thin yellow midribs and 3 or 4, usually 3 pairs of slender primary veins; petioles slender, slightly wing-margined at the apex, sparingly hairy on the upper side while young, becoming glabrous, glandular, with minute persistent glands, 1.5-3.5 cm in length; leaves on vigorous shoots thicker, rounded at the broad base, more coarsely serrate and more deeply lobed, often 7-8 cm long and 6-7 cm wide. Flowers 1.5 cm in diameter, on long slender sparingly villose pedicels, in compact mostly 5-7-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from wide bases, short, acuminate, entire or irregularly dentate, glabrous,

reflexed after anthesis; stamens 10, filaments persistent on the fruit; anthers yellow; styles 3 or 4, densely coated with white hairs from the base nearly to the middle, surrounded by a narrow ring of pale tomentum. Fruit ripening at the end of September, on slender still slightly hairy pedicels, in few-fruited drooping clusters, short-oblong, full and rounded at the ends or slightly narrowed at the apex, dull greenish red, pruinose, marked by large pale dots, about 1 cm in diameter; calyx little enlarged, with a deep narrow cavity, and spreading lobes, their tips incurved and often deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 3 or 4, narrowed and rounded at the ends or acute at the apex, irregularly grooved or occasionally slightly ridged on the back, 6-7 mm long, and 4-5 mm wide.

A shrub, with slender nearly straight glabrous branchlets, green tinged with red when they first appear, becoming bright chestnut-brown, lustrous and marked by numerous pale lenticels in their first season and dull reddish brown the following year, and armed with slender slightly curved or straight chestnut-brown shining spines 2.5-3 cm long.

In moist soil, Chapinville, Ontario co., J. Dunbar and C. S. Sargent (* E, type), October 1, 1902, M. S. Baxter, May 30 and September 20, 1903.

This and *Crataegus delawarensis* Sargent are the only species of *Pruinosae* that have yet been seen with 10 stamens and yellow anthers. From *C. delawarensis* it differs in the scabrate young leaves and villose pedicels, and from all other species in the dense covering of hairs on the lower part of the styles.

IV TENUIFOLIAE

Fruit short-oblong to obovate, red or scarlet, lustrous; anthers rose color or pink; leaves thin, hirsute on the upper surface while young.

Stamens 10 or less

Leaves yellow-green

Leaves glabrous at maturity; pedicels glabrous

Fruit usually short-oblong

Stamens 10; anthers pink

Flowers 1.6 cm in diameter, in wide loose corymbs.....1 *C. slavini*

Flowers not more than 1.2 cm in diameter, in compact corymbs 2 *C. boothiana*

Stamens 7-10; anthers dark rose color.....3 *C. suavis*

Fruit obovate.....4 *C. colorata*

Leaves scabrate at maturity; pedicels villose...5 *C. rubicunda*

Leaves blue-green**Leaves glabrous at maturity****Fruit short-oblong**

Leaves oblong-ovate, deeply lobed, usually only above the middle; fruit often 1.4 cm in length.....6 *C. ornata*

Leaves broadly ovate, laterally lobed; fruit generally not more than 1 cm long.....7 *C. bella*

Leaves oval, only slightly lobed.....8 *C. genialis*

Fruit obovate.....9 *C. tenuiloba*

Leaves scabrate at maturity.....10 *C. streeterae*

Stamens 20

Leaves broadly ovate; flowers in compact corymbs; fruit short-oblong, in erect clusters.....11 *C. conferta*

Leaves oblong-ovate; flowers in wide long-branched corymbs; fruit obovate, in drooping clusters.....12 *C. luminosa*

***Crataegus slavini* n. sp.**

Leaves oblong-ovate, acuminate, broad and rounded or gradually narrowed and cuneate at the base, finely doubly serrate, with straight glandular teeth, and divided into 5-8 pairs of widespreading often incurved acuminate lateral lobes; nearly half grown when the flowers open about the 25th of May and then thin, yellow-green and roughened above by short white hairs and pale and glabrous below, and at maturity thin but firm in texture, bright yellow-green, smooth and lustrous on the upper surface and pale and glaucous on the lower surface, 4.5-7 cm long and 4-5.5 cm wide, with stout midribs and slender primary veins arching obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, glandular, with minute persistent glands, 2-3 cm in length; leaves on vigorous shoots thin, rounded or slightly cordate at the base, more deeply lobed, often 6-7 cm long and 5-6 cm wide. Flowers 1.5-1.6 cm in diameter, on long slender glabrous pedicels, in wide lax, mostly 8-10-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes abruptly narrowed from broad bases, slender, acuminate, entire or occasionally obscurely dentate, glabrous, reddish, reflexed after anthesis; stamens 10; anthers pink; styles 3 or 4, surrounded at the base by a narrow ring of matted pale hairs. Fruit ripening from the first to the middle of October and persistent after the fall of the leaves, on slender reddish pedicels, in few-fruited drooping clusters, short-oblong or slightly obovate, somewhat angled, bright orange-red, lustrous, marked by numerous small pale dots, 1.2-1.4 cm long, and about 1 cm wide; calyx prominent, with a narrow deep cavity, and spreading and slightly incurved lobes, dark

red on the upper side below the middle, their tips often deciduous from the ripe fruit; flesh thick, yellow, sweet and succulent; nutlets 3 or 4, narrowed at the ends, acute at the apex, prominently ridged on the back, with a broad deeply grooved ridge, 6-7 mm long, and 4 mm wide.

A shrub 3-4 m high, with erect intricately branched stems covered with pale gray bark and spreading into broad thickets, and slender nearly straight glabrous branchlets, dark orange color and marked by many pale lenticels when they first appear, becoming dull reddish brown in their first season and dark gray-brown the following year, and armed with straight or slightly curved chestnut-brown shining spines 3-4 cm long.

Brighton near Rochester, B. H. Slavin (* 1, type, and 4), October 12, 1903, May 24, 1904.

This species is named for Bernard Henry Slavin of Seneca park, Rochester, for many years a diligent and careful student and collector of *Crataegus* in western New York.

***Crataegus boothiana* n. sp.**

Leaves ovate, acuminate and often long pointed at the apex, rounded at the base, finely often doubly serrate, with straight slender glandular teeth, and divided into 5 or 6 pairs of acuminate spreading lobes; tinged with red when they unfold, nearly half grown when the flowers open about the 20th of May and then membranaceous, yellow-green and roughened above by short white hairs and pale and glabrous below, and at maturity thin, light yellow-green, glabrous and lustrous on the upper surface and pale bluish green on the lower surface, 5-6 cm long and 4-4.5 cm wide, with slender midribs, and thin primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, glabrous, glandular, with occasional minute scattered often persistent glands, 1-2.5 cm in length; leaves on vigorous shoots rounded or often cordate at the broad base, deeply lobed, with stout winged conspicuously glandular petioles. Flowers about 1.2 cm in diameter, on slender glabrous pedicels, in compact mostly 8-10-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, entire or slightly toothed near the base, glabrous, red above the middle, reflexed after anthesis; stamens 10; filaments persistent on the fruit; anthers pink; styles 3, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the middle of September, on short reddish pedicels, in few-fruited drooping

clusters, short-oblong, full and rounded at the ends, bright orange-red, lustrous, marked by occasional small pale dots, 1-1.2 cm long and 8-9 mm wide; calyx prominent, with a broad shallow cavity, the lobes elongated, spreading, dark red on the upper side below the middle, their tips usually deciduous from the ripe fruit; flesh thin, yellow, slightly juicy; nutlets 3, narrowed and rounded at the base, acute at the apex, ridged on the back, with a narrow high ridge, 5-6 mm long, and 3-4 mm wide.

A shrub 2-2.5 m high, with small erect stems forming an open irregular head, and slender nearly straight glabrous branchlets light green tinged with red when they first appear, becoming dull reddish brown and marked by small pale lenticels in their first season and dull gray-brown the following year, and armed with stout or slender nearly straight purplish shining spines 2.5-3 cm long.

Wooded banks, near Rochester, J. Dunbar (*132, type), September 8, 1902, May 16 and September 16, 1903; Murray, common, M. S. Baxter (*133), October 11, 1902; Filmore, Baxter and Dewing (*309), September 4, 1905.

At the suggestion of Mr Dunbar this species is named in memory of Charles Miller Booth, M. D. (October 12, 1830-January 30, 1906), a resident of Rochester during nearly the whole of his life and a careful student of the flora of western New York, especially of the mosses and grasses in which he was particularly interested.

***Crataegus suavis* n. sp.**

Leaves ovate, acuminate, rounded or abruptly concave-cuneate at the entire base, doubly serrate above, with slender glandular teeth, and divided into 5 or 6 pairs of acuminate spreading lateral lobes; tinged with red and roughened above by short white hairs when they unfold, about half grown when the flowers open at the end of May and then membranaceous, yellow-green, smooth and scabrate above, and at maturity thin, yellow-green, smooth and glabrous on the upper surface and pale on the lower surface, 5.6-7 cm long and 4.5 cm wide, with slender yellow midribs, and thin primary veins arching obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, glandular, with persistent glands, 2-2.5 cm long; stipules linear to linear-obovate, glandular, foliaceous and lunate on vigorous shoots, glandular, caducous. Flowers 1.5 cm in diameter, on slender elongated glabrous pedicels, in lax thin branched usually 7-10-flowered corymbs, with linear glandular bracts and bractlets fading brown; calyx-tube narrowly obconic,

glabrous, the lobes long, slender, acuminate, entire, glabrous, reflexed after anthesis; stamens 7-9; anthers light rose color; styles 2 or 3, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening from the middle to the end of September, on slender drooping pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends or slightly narrowed toward the base, orange-red, lustrous, marked by small pale dots, 1-1.3 cm long, and 8-9 mm wide; calyx little enlarged, with a deep narrow cavity, and slender closely appressed lobes, their tips often deciduous from the ripe fruit; flesh thick, pale yellow, sweet and juicy; nutlets 2 or 3, gradually narrowed and rounded at the ends, ridged on the back, with a low deeply grooved ridge, 7-8 mm long, and about 4 mm wide.

A shrub sometimes 4 m high, with small erect stems and branches, and slender slightly zigzag glabrous branchlets, dark orange-green deeply tinged with purple when they first appear, becoming dull reddish-brown and marked by small pale lenticels in their first season and light gray-brown the following year, and armed with slender straight purplish spines 2.5-3.5 cm long.

Buffalo, J. Dunbar (* 9, type), September 29, 1903, June 1, 1905, and May 28, 1905; (* 18), J. Dunbar, May 28, 1905.

***Crataegus colorata* Sargent**

Rochester Acad. Sci. Proc. IV. 123 (1903).

Buffalo, common, J. Dunbar, September 26, 1905, May 28, 1906; Niagara Falls, J. Dunbar, September 28, 1905; also near Rochester, New York.

***Crataegus rubicunda* Sargent**

Rochester Acad. Sci. Proc. IV. 121 (1903).

Buffalo, J. Dunbar, May 21, 1903, May 28, 1906; also near Rochester, New York.

***Crataegus ornata* Sargent**

Rochester Acad. Sci. Proc. IV. 120 (1903).

Buffalo, J. Dunbar (* 42), October 6, 1902, May 28, 1906; also near Rochester, New York.

***Crataegus bella* n. sp.**

Leaves ovate, acuminate, rounded or abruptly cuneate at the broad entire base, finely doubly serrate above, with straight slender glandular teeth, and divided into 4 or 5 pairs of narrow acuminate spreading lateral lobes; dark red and covered on the upper surface with short white hairs when they first appear, nearly fully grown when the flowers open at the end of May and then membranaceous, light yellow-green and scabrate above and pale below, and at maturity thin but firm in texture, dark bluish green and very smooth on the upper surface, pale blue-green on the lower surface, 3.5-4.5 cm long and 3-3.5 cm wide, with slender midribs and thin primary veins; petioles slender, slightly wing-margined at the apex, glandular, with large dark glands occasionally persistent during the season, often rose color in the autumn, 1.5-2 cm in length; leaves on vigorous shoots rounded or slightly cordate at the base, and usually as broad as long, with stout broad-winged rose colored petioles. Flowers 1.6 cm in diameter, on slender glabrous pedicels, in crowded many-flowered corymbs, with linear bracts and bractlets fading brown; calyx-tube narrowly obconic, glabrous, the lobes slender, elongated, entire or sparingly dentate, glabrous, reflexed after anthesis; stamens, 10; anthers rose color; styles 3 or 4, surrounded at the base by a narrow ring of pale hairs. Fruit very showy, in wide many-fruited erect or spreading clusters, full and rounded at the ends or slightly narrowed from below the middle to the base, scarlet, lustrous, marked by many small pale dots, about 1 cm long and 8-9 mm wide; calyx prominent, with a broad deep cavity, and spreading or slightly incurved persistent lobes red on the upper side toward the base; flesh thick, yellow, sweet and juicy; nutlets 3 or 4, narrowed and acute at the ends, ridged on the back, with a broad doubly grooved ridge 7-8 mm long, and 4-5 mm wide.

A shrub 3-4 m high, with stout ascending tortuous stems, small spreading branches, and slender zigzag branchlets dark purple and puberulous when they first appear, soon glabrous, becoming bright chestnut-brown and lustrous in their first season and dull gray-brown the following year, and armed with stout straight or slightly curved bright chestnut-brown shining ultimately dull gray-brown spines 2.5-3.5 cm long.

Buffalo, J. Dunbar (* 24, type), September 24, 1904, May 28, 1905.

***Crataegus genialis* Sargent**

Rhodora V. 148 (1903).

Buffalo, J. Dunbar and C. S. Sargent (*18), September 24, 1904, J. Dunbar, May 21, 1905; also eastern New York and western Massachusetts.

***Crataegus tenuiloba* Sargent**

Rochester Acad. Sci. Proc. IV. 122 (1903).

Buffalo, J. Dunbar (*19 and 30), September 30, 1904, May 28, 1905; also near Rochester, N. Y.

***Crataegus streeterae* Sargent**

Rochester Acad. Sci. Proc. IV. 119 (1903).

Buffalo, J. Dunbar, May 28, 1906; Niagara Falls, September 27, 1905, May 28, 1906; also at Rochester, N. Y.

***Crataegus conferta* n. sp.**

Leaves broadly ovate, acuminate or rounded and short pointed at the apex, rounded or slightly cordate at the entire base, finely serrate above, with straight glandular teeth, and slightly divided into 3 or 4 pairs of small acuminate spreading lobes; tinged with red and covered above with soft white hairs when they unfold, nearly fully grown when the flowers open at the end of May and then membranaceous, light yellow-green and scabrate above, and at maturity thin, glabrous, yellow-green and smooth on the upper surface, paler on the lower surface, 3-4 cm long and 3-3.5 cm wide, with comparatively stout midribs, and 4 or 5 pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, glandular throughout the season, 1.5-1.8 cm in length; leaves on vigorous shoots somewhat thickened, cuneate at the base, more coarsely serrate, more deeply lobed, and often 5-6 cm long and 4-5 cm wide, with stout shorter broadly winged petioles. Flowers 1.8 cm in diameter, on short glabrous pedicels, in very compact crowded usually 7-8-flowered showy corymbs, with linear glandular bracts and bractlets; calyx-tube broadly obconic, the lobes slender, elongated, entire or sparingly dentate, glabrous, reflexed after anthesis; stamens 20; filaments persistent on the ripe fruit; anthers rose color; styles 3, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening at the end of September, on short stout

reddish pedicels, in compact few-fruited erect clusters, short-oblong, slightly narrowed from the middle to the ends, orange-red, lustrous, marked by small pale dots, about 1.2 cm long and 8 mm wide; calyx little enlarged, with a deep narrow cavity, and small closely appressed persistent lobes bright red on the upper side; flesh thick, yellow, dry and sweet; nutlets 3, narrowed and acute at the ends or broader and rounded at the base, rounded and only slightly ridged on the back, about 7 mm long, and 4 mm wide.

A shrub 3-4 m high, with small ascending stems, and slender nearly straight branchlets dark orange-green more or less tinged with purple and puberulous when they first appear, soon glabrous, becoming bright chestnut-brown, lustrous, and marked by numerous small dark lenticles in their first season and dull reddish brown the following year, and armed with stout straight or slightly curved chestnut-brown shining spines 2-3 cm long.

Buffalo, J. Dunbar (✱ 10, type), May 28 and September 26, 1905; J. Dunbar (✱ 37), May 28, 1905.

***Crataegus luminosa* n. sp.**

Leaves oblong-ovate, acuminate, rounded, truncate or rarely cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of small acuminate lateral lobes; deeply tinged with red and covered on the upper surface with soft white hairs and glabrous below when they unfold, about half grown when the flowers open at the end of May and then yellow-green and scabrate above, and at maturity thin, glabrous, smooth and yellow-green on the upper surface, pale on the lower surface, 5-6 cm long and 3.5-4.5 cm wide, with slender yellow midribs and thin primary veins extending to the points of the lobes; petioles very slender, slightly wing-margined at the apex, glandular throughout the season, often tinged with rose color in the autumn, 2-3 cm in length; stipules linear, glandular, fading brown, caducous; leaves on vigorous shoots long-pointed, cordate at the base, more coarsely serrate and more deeply lobed. Flowers 1.8 cm in diameter, on long slender glabrous pedicels, in wide long-branched usually 8-10-flowered corymbs, the lowest peduncles from the axils of upper leaves; calyx-tube broadly obconic, glabrous, the lobes short, slender, sparingly dentate near the middle, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; petals reflexed; stamens 20; anthers dark red; styles 5, surrounded at the base by a narrow ring of pale tomentum. Fruit

ripening early in September and soon falling, on stout red pedicels, in few-fruited drooping clusters, obovate, rounded at the apex, gradually narrowed from above the middle to the base, dark crimson, lustrous, marked by many small pale dots; calyx little enlarged, with a deep narrow cavity, the lobes usually deciduous from the ripe fruit; flesh thick, yellow, soft and juicy; nutlets 5, thin, rounded at the base, gradually narrowed and acute at the apex, slightly grooved on the back, about 7 mm long, and 4-5 mm wide.

A shrub sometimes 5 m high, with numerous ashy gray stems, small ascending and spreading branches, and slender slightly zigzag branchlets, dark orange-green deeply tinged with purple when they first appear, becoming in their first season light chestnut-brown, lustrous and marked by many small pale lenticels, and dull gray-brown the following year, and armed with stout slightly curved chestnut-brown or purplish spines 3-4 cm long.

Low wet woods, Buffalo, J. Dunbar (* 36, type), May 28 and September 26, 1905.

V MOLLES

Fruit subglobose to obovate, scarlet, pubescent at the ends; flesh thick and succulent; nutlets 3-5, narrowed at the ends, usually slightly ridged; corymbs hairy; leaves thin, broad, cuneate or rounded at the base; stamens 15-20; anthers rose color.

Crataegus radians n. sp.

Leaves oval to ovate, acuminate, concave-cuneate or rounded at the often unsymmetrical glandular base, sharply doubly serrate above, with straight glandular teeth, and divided often only above the middle into 6 or 7 pairs of slender acuminate spreading lobes; nearly half grown when the flowers open about the 20th of May and then thin, light yellow-green and roughened above by short white hairs and villose below, and at maturity thin, yellow-green and scabrate on the upper surface, paler and coated below on the slender midribs and primary veins with matted white hairs, 6-8.5 cm long and 4-5 cm wide; petioles slender, slightly wing-margined at the apex, villose, 2.5-3.5 cm in length; leaves on vigorous shoots rounded or truncate at the broad base, more coarsely serrate and more deeply lobed, often 9-10 cm long and 8-9 cm wide, with slender glandular petioles. Flowers 1.7-1.9 cm in diameter, on slender villose pedicels, in wide lax 5-16-flowered hairy corymbs, with linear-obovate to linear glandular bracts and

bractlets fading brown and mostly persistent until the flowers open; calyx-tube narrowly obconic, thickly coated with long white hairs, the lobes gradually narrowed from wide bases, slender, acuminate, entire or minutely and irregularly glandular serrate, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 15-20; usually 20; anthers dark rose color; styles 4 or 5, surrounded at the base by a narrow ring of long white hairs. Fruit ripening from the 20th to the end of September, on stout villose reddish pedicels, in few-fruited drooping clusters, short-oblong, full and rounded at the ends or obovate and slightly narrowed at the base, crimson, lustrous, puberulous at the ends, marked by large pale dots; calyx little enlarged, with a deep narrow cavity, and slender spreading recurved usually persistent lobes dark red on the upper side below the middle; flesh thin, juicy, dark yellow; nutlets 4 or 5, gradually narrowed and acute at the ends or rounded at the base, rounded and grooved or irregularly ridged on the back, 6-7 mm long, and 4-5 mm wide.

An arborescent shrub 7-8 m high, with stout spreading stems covered with light gray scaly bark, small spreading and ascending branches forming an open irregular head, and slender slightly zig-zag branchlets, covered when they first appear with long matted white hairs, light red or orange-brown, pubescent and marked by pale lenticels in their first season, darker colored and glabrous the following year and ultimately ashy gray, and armed with slender nearly straight chestnut-brown shining spines 4.5-5 cm long.

Low moist woods, Rochester (Knickerbocker woods), Baxter and Dewing (* 302, type), October 10, 1904, May 21 and September 24, 1905, J. Dunbar, May 21, 1905.

VI FLABELLATAE

Fruit short-oblong to oval or obovate, scarlet, lustrous, 1.5-2 cm long; flesh succulent; nutlets 3-5, grooved and occasionally ridged on the back; leaves large, thin, ovate to oblong, more or less acutely lobed; anthers rose color or pink.

Stamens 20

Leaves broadly ovate, glabrous above at maturity; fruit obovate.....

..... 1 *C. dayana*

Leaves oblong-ovate, scabrate above at maturity; fruit short-oblong.....

..... 2 *C. limosa*

Stamens 10

Anthers pink; leaves ovate, glabrous above at maturity; fruit

obovate..... 3 *C. letchworthiana*

- Anthers rose color; leaves broadly ovate, scabrate above, at maturity; fruit short-oblong.....4 *C. pedicellata*
 Stamens 7-10
 Flowers 2.4 cm in diameter, on slightly villose pedicels, in broad 10-15-flowered corymbs; anthers pale pink; fruit short-oblong, truncate at the apex, often unsymmetrical and mammillate at the base.....5 *C. gloriosa*
 Flowers not more than 1.5 cm in diameter, on densely villose pedicels, in compact 8-10-flowered corymbs; anthers dark rose color; fruit subglobose to oval.....6 *C. sejuncta*
 Stamens 5-7, usually 5
 Leaves oval to ovate, light yellow-green; flowers cup-shaped, on glabrous or slightly villose pedicels; fruit oblong to oval.....7 *C. holmesiana*
 Leaves oblong-ovate, dark yellow-green; flowers not cup-shaped; pedicels densely villose; fruit short-oblong.....8 *C. acclivis*

***Crataegus dayana* n. sp.**

Leaves broadly ovate, acuminate, abruptly concave-cuneate or rounded at the entire or glandular base, sharply doubly serrate, with slender glandular teeth, and divided into 6 or 7 pairs of narrow acuminate spreading lateral lobes; when they unfold tinged with rose color and coated with soft white hairs more abundant on the lower than on the upper surface, nearly two thirds grown when the flowers open the last week of May and then very thin, yellow-green and scabrate above and pale and slightly hairy along the midribs and veins below, with short sometimes persistent hairs, and at maturity thin, dark yellow-green, smooth and glabrous on the upper surface, pale on the lower surface, 8-10 cm long and 7-9 cm wide, with stout midribs, and primary veins arching to the point of the lobes; petioles slender, wing-margined at the apex, slightly villose while young, becoming glabrous, rose colored in the autumn, 3-4 cm in length; stipules linear, only slightly glandular, fading brown, caducous; leaves on vigorous shoots thicker, cordate at the broad base, very coarsely serrate, more deeply lobed and often 10-11 cm long and wide, with stout glandular red petioles 2-2.5 cm in length, and foliaceous lunate glandular serrate deciduous stipules. Flowers 2-2.2 cm in diameter, on long stout slightly hairy pedicels, in wide lax long-branched usually 10-14 flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from broad bases, long, acuminate, coarsely glandular serrate above the middle, glabrous on the outer, slightly villose on the inner surface, reflexed after an-

thesis; stamens 20; anthers pink; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening from the first to the middle of September and soon falling, on long stout glabrous reddish drooping pedicels, in few-fruited clusters, obovate, full and rounded at the apex, gradually narrowed from above the middle to the base and sometimes decurrent on the pedicel, crimson, lustrous, marked by many small pale dots; calyx prominent, with a wide very deep cavity, and spreading and incurved coarsely serrate persistent lobes dark red on the upper side toward the base; flesh thick, dark yellow, juicy and edible; nutlets 3 or 4, acute at the ends, ridged on the back, with a narrow high ridge, 7-8 mm long, and about 5 mm wide.

A tree sometimes 5 m high, with a trunk occasionally 3 dm in diameter, covered with ashy gray bark, spreading horizontal branches forming a compact shapely head, and slender slightly zigzag glabrous branchlets dark orange-green deeply tinged with purple when they first appear, becoming bright chestnut-brown, very lustrous and marked by small pale lenticels in their first season and dull reddish brown the following year, and armed with slender nearly straight bright chestnut-brown shining spines 3.5-4.5 cm long; or an arborescent shrub, with numerous small stems.

Buffalo, J. Dunbar and C. S. Sargent (* 7, type), September 24, 1904, J. Dunbar, May 28, 1905.

This handsome tree is named in memory of David Fisher Day (June 11, 1829-August 21, 1901), the author with Judge Clinton, of *A Catalogue of the Native and Naturalized Plants of the City of Buffalo and its Vicinity* (1883), and of *A Catalogue of the Flowering and Fern-like Plants growing without Cultivation in the Vicinity of the Falls of Niagara* (1888).

***Crataegus limosa* n. sp.**

Leaves oblong-ovate, acuminate, concave-cuneate or gradually narrowed and rounded at the entire base, coarsely doubly serrate above, with straight glandular teeth, and divided often only above the middle into 6 or 7 narrow acuminate lobes; more than half grown when the flowers open from the 15th to the 20th of May and then very thin, bright green and roughened above by short white hairs and pale bluish green and glabrous below, and at maturity thin, dark yellow-green and scabrate on the upper surface and pale yellow-green on the lower surface, 6-8 cm long and 4-5 cm wide, with stout orange colored midribs, and thin primary veins ex-

tending obliquely to the points of the lobes; petioles slender, narrowly wing-margined at the apex, slightly hairy on the upper side while young, soon glabrous, occasionally minutely glandular, 1.5–2.5 cm in length; leaves on vigorous shoots more deeply lobed and often 8–9 cm long and 6–6.5 cm wide. Flowers 1.8 cm in diameter, on long slender slightly hairy pedicels, in mostly 8–10-flowered compact thin-branched corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes slender, elongated, minutely glandular-dentate, glabrous on the outer, pubescent on the inner surface, reflexed after anthesis; stamens 20–25; anthers red; styles 2–4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the end of September, on stout nearly glabrous reddish pedicels, in few-fruited drooping clusters, short-oblong, full and rounded at the ends, crimson, lustrous, marked by large pale dots, 1–1.2 cm long and 8–10 mm wide; calyx little enlarged, with a deep narrow cavity, and spreading reflexed lobes red below the middle on the upper side and often deciduous from the ripe fruit; flesh thick, yellow, sweet and succulent; nutlets 2, narrowed and rounded at the ends or acute at the apex, ridged on the back, with a high often doubly grooved ridge, about 7 mm long, and 4 mm wide.

An arborescent shrub 5–7 m high, with widespreading stems often 2 dm in diameter and 1 m long covered with gray scaly bark, small drooping branches, forming a wide irregular open head, and slender zigzag glabrous branchlets dark orange-yellow and marked by pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season and dull gray-brown the following year, and armed with few slender slightly curved chestnut-brown shining spines 3–4 cm long.

In the dense shade of thick woods, Hagaman's swamp near Rochester, J. Dunbar (*QQ), October 12, 1901, September 26, 1903, May 19 and September 26, 1902.

***Crataegus letchworthiana* n. sp.**

Leaves ovate, acute or acuminate, concave-cuneate or rounded at the broad entire base, finely doubly serrate above, with straight glandular teeth, and slightly divided usually only above the middle into 3 or 4 pairs of small spreading acuminate lobes; slightly tinged with red when they unfold, nearly half grown when the flowers open at the end of May and then thin, yellow-green and covered above by soft white hairs and pale and slightly villose along the midribs and veins below, and at maturity thin but firm in texture,

yellow-green, smooth and glabrous on the upper surface, still slightly hairy along the slender yellow midribs and primary veins on the lower surface, 5-6 cm long and 4-5 cm wide; petioles slender, slightly wing-margined at the apex, hairy along the upper side when young, becoming nearly glabrous, glandular, with minute persistent glands, 1.5-2.5 cm in length; leaves on vigorous shoots rounded or slightly cordate at the base, long-pointed, more coarsely serrate, deeply divided into spreading or incurved lateral lobes, and 6-7 cm long and broad. Flowers 2 cm in diameter, on long slender slightly hairy pedicels, in broad rather compact mostly 10-15-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, finely glandular serrate below the middle, glabrous on the outer, pubescent on the inner surface, reflexed after anthesis; stamens 10; anthers pink; styles 2-4. Fruit ripening early in September, on glabrous reddish pedicels, in drooping many-fruited clusters, obovate and rounded at the apex, gradually narrowed at the base, scarlet, lustrous, marked by many small pale dots, 1.2-1.3 cm long and 1-1.1 cm in diameter; calyx little enlarged, with a wide shallow cavity, and spreading often persistent lobes dark red on the upper side below the middle and slightly hairy above; flesh thick, yellow, sweet and juicy; nutlets 2-4, narrowed and rounded at the ends, or acute at the apex, prominently and irregularly ridged on the back, with a broad deeply grooved ridge or rounded and slightly grooved on the back, 7-8 mm long, and 5-6 mm wide.

A tree 8-10 m high, with a trunk often 3 dm in diameter, spreading and ascending branches forming a broad round-topped symmetrical head, and slender glabrous branchlets orange-green and slightly tinged with red when they first appear, becoming dull light chestnut-brown and marked by small pale lenticels in their first season and light gray-brown and rather lustrous the following year.

Meadows near Portage, Baxter and Dewing (* 249), September 7, 1904 and May 29, 1905.

This beautiful tree is named for the distinguished philanthropist, William P. Letchworth of Buffalo, for a long time chairman of the State Board of Charities of New York, on whose farm at Portage I saw it in the autumn of 1904.

***Crataegus pedicellata* Sargent**

Bot. Gazette, XXXI. 226 (1901); Silva N. Am. XIII, 101, t. 677; Rochester Acad. Sci. Proc. IV. 116; Man. 448, f. 305.

Buffalo, J. Dunbar, September 26, 1905, May 28, 1906; abundant through Monroe and Ontario counties, New York.

***Crataegus gloriosa* n. sp.**

Leaves ovate, acuminate, gradually narrowed and rounded or abruptly concave-cuneate at the entire base, coarsely doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of stout acuminate spreading lateral lobes; more than half grown when the flowers open from the 20th to the end of May and then yellow-green and roughened above by short white hairs and paler and slightly hairy along the midribs and primary veins below, and at maturity thin, slightly convex, dark green and scabrate on the upper surface, pale yellow-green and often still slightly hairy on the thin yellow midribs and primary veins below, 6-8 cm long and 5-7 cm wide; petioles slender, slightly wing-margined at the apex, sparingly villose on the upper side while young, often becoming glabrous, occasionally glandular, 3-4 cm in length; leaves on vigorous shoots thicker, rounded or abruptly cuneate at the base, more coarsely serrate and more deeply lobed, often 10-12 cm long and 9-10 cm wide, with prominent midribs and veins, and stout glandular petioles. Flowers 2.2-2.4 cm in diameter, on long slender slightly villose pedicels, in wide erect or spreading 10-15-flowered corymbs, with oblong-obovate to linear glandular rose colored bracts and bractlets often persistent until the flowers open; calyx-tube narrowly obconic, glabrous, tinged with red, the lobes abruptly narrowed from broad bases, large, acuminate, coarsely glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; claws of the petals concave and forming conspicuous cavities; stamens 7-10; anthers light pink; styles 3-5, surrounded at the base by a wide ring of long white hairs. Fruit ripening the middle of September, on stout slightly hairy reddish pedicels, in few-fruited erect or spreading clusters, short-oblong, broad and truncate at the apex, sometimes slightly narrowed below and then often unsymmetrical at the base by the development of a mammillate process adnate to the pedicel, deep crimson, very lustrous, marked by large pale dots, 1.8-2.2 cm long and 1.5-1.8 cm in diameter; calyx prominent, with a broad deep cavity, and erect and incurved persistent lobes; flesh thick, yellow, sweet, very juicy, of excellent flavor; nutlets 3-5, acute at the apex, rounded and slightly ridged on the back, 6-7 mm long, and 3-4 mm wide

A tree often 8-9 m high, with a tall trunk covered with pale close bark, and sometimes 3 dm in diameter, spreading and ascending branches forming a broad symmetrical round-topped head, and

slender slightly zigzag glabrous branchlets dark orange color and marked by numerous pale lenticels when they first appear, becoming light reddish brown and lustrous in their first season and pale orange-brown the following year, and armed with few stout straight or slightly curved chestnut-brown shining spines 3-3.5 cm long.

Clay soil near the borders of woods, Rochester, J. Dunbar (* L, type), May 31, 1901, J. Dunbar and C. S. Sargent, September 27, 1901, September 19 1902; Rochester (Knickerbocker woods), Baxter and Dewing (* 304), May 21 and September 25, 1905.

Formerly referred to *Crataegus pedicellata* Sargent, the "L" tree of Rochester is distinct from that species in its larger flowers peculiar in the development of sacklike cavities at the base of the petals, by its pink not dark rose colored anthers, by the much larger and more lustrous fruit usually mammillate at the base and ripened 10 to 12 days earlier, and by its convex leaves. In habit, in its large and abundant flowers, and in the large and brilliant abundant fruits, *C. gloriosa* is not surpassed in beauty by any North American *Crataegus*.

***Crataegus sejuncta* Sargent**

N. Y. State Mus. Bul. 105. 62 (1906).

Buffalo, J. Dunbar (* 34), May 28 and September 30, 1905; also near Albany, New York, and in western New England.

***Crataegus holmesiana* Ashe**

Jour. Elisha Mitchell Sci. Soc. XVI. pt 11. 78 (1899), Sargent, Bot. Gazette XXXI. 10; Silva N. Am. XIII. 119, t. 676; Rochester Acad. Sci. Proc. IV. 114; Man. 449, f. 366.

Buffalo, J. Dunbar (* 35). September 30, 1904, May 28, 1905; also near Rochester, New York and eastward to eastern Massachusetts and eastern Pennsylvania.

***Crataegus acclivis* Sargent**

Rochester Acad. Sci. Proc. IV. 115 (1903); Man. 459, f. 367.

Niagara Falls, J. Dunbar, September 28, 1905, May 28, 1906; also near Rochester and Albany, New York.

VII DILATATAE

Fruit medium size, subglobose, scarlet; calyx much enlarged; nutlets 5, prominently ridged on the back; corymbs many-flowered; stamens 20; anthers rose color; leaves thin, on vigorous shoots as broad or broader than long.

Crataegus durobrivensis Sargent

Trees and Shrubs 1. 3, t. 2 (1902); Rochester Acad. Sci. Proc. IV. 114.
Sargent and Peck, N. Y. State Mus. Bul. 105. 64 (1906).

Niagara Falls, J. Dunbar, September 28, 1905; near Hemlock lake, Livingston co., Henry T. Brown, May and October 1906; also near Rochester and Albany, New York.

VIII COCCINEAE

Leaves cuneate at the base, subcoriaceous or thin dark green and lustrous above; fruit subglobose, 9-15 mm in diameter.

Siemens 5-10

Anthers pale yellow

Leaves subcoriaceous; fruit 1.2-1.5 cm in diameter.....I *C. coccinea*

Leaves thin; fruit usually less than 1 cm in diameter 2 *C. dodgei*

Antthers rose color

Leaves thin; fruit 1-1.3 cm in diameter.....3 *C. puberis*

Stamens, 20; anthers pink; leaves thin; ovate to oval or rhombic.....
4 *C. neo-baxteri*

Crataegus coccinea Linneus

Spec. I. 476 (1753). Sargent, Bot. Gazette XXXI. 14; Silva N. Am.
XIII. 133, t. 683; Man. 459, f. 375.

Buffalo, J. Dunbar (♂40), May 31, June 12 and September 26, 1905; also on the New England coast and in the valley of the St Lawrence river.

Crataegus coccinea var. **rotundifolia** Sargent

Bot. Gazette XXXI. 14 (1900); Silva N. Am. XIII. 134; Man. 460; Acad. Sci. Phila. Proc. IV. 631.

Buffalo, J. Dunbar (*E), September 25, 1901; (*33), September 30, 1904 and May 28, 1905; also common from Canada to eastern Pennsylvania.

Crataegus dodgei Ashe

Jour. Elisha Mitchell Sci. Soc. XIX. 26 (March 1903). Sargent, Acad. Sci. Phila. Proc. 632 (1905); Rhodora VII. 213 (*Crataegus gravesii* Sargent, Rhodora V. 159 (June 1903)). (*Crataegus fallens* Gruber, Bucks County Nat. Sci. Club. Proc. 1. 19 (October 1903)).

Buffalo, J. Dunbar (* B), September 25, 1901, May 26 and October 6, 1902, (* 12), September 29, 1903 and June 1, 1904; also from southern Michigan to eastern Massachusetts and eastern Pennsylvania.

Crataegus puberis n. sp.

Leaves rhombic to obovate, acuminate, gradually narrowed and concave-cuneate at the long entire base, finely doubly serrate above, with straight or incurved glandular teeth and slightly divided above the middle into 4 or 5 pairs of small acuminate lobes; more than half grown when the flowers open from the 20th to the 25th of May and then thin, dark yellow-green and covered above by soft white hairs and paler and villose below, and at maturity thin and firm in texture, dark green and glabrous on the upper surface, light yellow-green and nearly glabrous on the lower surface, 4.5-5.5 cm long and 3-4.5 cm wide, with slender slightly villose yellow midribs and veins; petioles slender, broadly wing-margined at the apex, hairy on the upper side, 1.5-3 cm in length. Flowers 1.2-1.3 cm in diameter, on slender densely villose pedicels, in compact 5-10-flowered corymbs, with linear glandular bracts and bractlets fading brown and often persistent until the flowers open; calyx-tube narrowly obconic, thickly coated with long matted pale hairs, the lobes slender, acuminate, obscurely glandular serrate, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 5-7; anthers dark rose color; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening about the middle of October, on slender slightly villose erect pedicels, in few-fruited clusters, short-oblong, full and rounded at the apex, slightly narrowed below, orange-red, lustrous, marked by pale dots, 1-1.3 cm long and 9-10 mm in diameter; calyx little enlarged, with a wide shallow cavity, and spreading and erect or recurved lobes dark red on the upper side below the middle; nutlets 3 or 4, rounded at the ends, rounded and only slightly grooved on the back, 6-7 mm long, and 4-5 mm wide.

A shrub sometimes 6-7 m high, with numerous stout gnarled stems covered with scaly bark, spreading and ascending branches, and slender nearly straight branchlets dark green and coated with matted white hairs when they first appear, becoming light orange color and glabrous during their first season and dull gray-brown the following year, and armed with occasional very slender nearly straight orange colored ultimately gray-brown spines 1-1.5 cm in length.

Borders of swamps and river bottoms in rich alluvial soil, near Belfast, Allegany co., Baxter and Dewing (*220, type), May 24, September 17 and October 17, 1903.

Crataegus neo-baxteri n. sp.

Leaves ovate to oval or rhombic, acuminate, cuneate and often unsymmetrical at the entire base, finely serrate above, with straight or incurved glandular teeth, and slightly divided above the middle into 4 or 5 pairs of small acuminate lateral lobes; nearly fully grown when the flowers open at the end of May and then thin, yellow-green, smooth and glabrous with the exception of a few hairs along the upper side of the midribs, and at maturity thin but firm in texture, yellow-green, glabrous, 4-4.5 cm long and 2-3.5 cm wide, with slender orange colored midribs and primary veins; petioles very slender, slightly wing-margined and sometimes minutely glandular at the apex, sparingly hairy along the upper side while young, becoming nearly glabrous, 2-2.5 cm in length. Flowers 1.8-2 cm in diameter, on very long slender glabrous pedicels, in wide lax 7-10-flowered corymbs, with linear glandular caducous bracts and bractlets, fading brown; calyx-tube narrowly obconic, glabrous, the lobes slender, acuminate, entire or occasionally obscurely dentate, glabrous, reflexed after anthesis; stamens 20, filaments persistent on the ripe fruit; anthers pink; styles 2 or 3, surrounded at the base by a narrow ring of pale hairs. Fruit ripening the end of September, on long very slender spreading reddish pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, rich deep red marked by large pale dots and covered by a thick glaucous bloom, 1-1.3 cm long and nearly as broad; calyx little enlarged, with a wide deep cavity, and spreading and recurved lobes often deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 3 or 4, gradually narrowed and rounded at the ends, slightly ridged on the back, 6-7 mm long, and about 4 mm wide.

A shrub 6-7 m high, with thin stems, spreading branches forming a broad symmetrical head, and slender glabrous branchlets light orange color when they first appear, becoming light chestnut-brown and lustrous in their first season and light gray-brown the following year, and armed with slender nearly straight red-brown spines 2-3 cm long.

Clay banks near Tuscarora, Livingston co., Baxter and Dewing (*251, type), May 30 and September 23, 1905.

With this species, described by its discoverers as being "as ornamental a species as we know in the genus," I am glad to associate the name of Mr M. S. Baxter, as the species which I named for him in the Proceedings of the Rochester Academy of Science, volume 4, page 107 was afterward found to have been described a few months

earlier by Ashe under another name from plants growing in Pennsylvania.

IX ANOMALAE

Fruit medium size, short-oblong, orange-scarlet; nutlets occasionally furnished with obscure ventral depressions; leaves usually cuneate at the base, thickish to subcoriaceous, scabrate above while young; petioles slender, elongated; flowers in many-flowered corymbs; anthers rose color or pink.

Stamens 20; leaves ovate to oval, divided above the middle into short broad lobes; fruit short-oblong.....1 *C. brachyloba*

Stamens 10

Leaves ovate to oval or suborbicular, often rounded at the base, nearly smooth at maturity; fruit subglobose.....2 *C. dunbari*

Leaves oval, scabrate above at maturity; fruit short-oblong.....3 *C. asperifolia*

Stamens 5-15; leaves oval to obovate, scabrate above at maturity; fruit subglobose.....4 *C. scabrida*

Crataegus brachyloba n. sp.

Leaves ovate to oval, acuminate, concave-cuneate at the entire base, finely doubly serrate above, with straight or incurved glandular teeth, and divided usually only above the middle into 5 or 6 pairs of very short acuminate spreading lobes; slightly tinged with red when they unfold, roughened above by short white hairs and glabrous below, more than half grown when the flowers open during the last week of May and then membranaceous, yellow-green and scabrate on the upper surface and pale on the lower surface, and at maturity thick to subcoriaceous, dark blue-green, smooth and glabrous above, pale below, 5-7 cm long and 3.5-5 cm wide, with slender yellow midribs, and 5 or 6 pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, glabrous, glandular often through the season, with minute scattered glands, and 2-3 cm in length; stipules linear, acuminate, glandular, fading brown, caducous; leaves on vigorous shoots subcoriaceous, long-pointed and acuminate at the apex, gradually narrowed and rounded at the base, coarsely serrate, with thick midribs and stout broadly winged conspicuously glandular rose colored petioles. Flowers 1.5 cm in diameter, on slender glabrous pedicels, in wide mostly 8-12-flowered corymbs, their lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from wide bases, entire, red and glandular at the acuminate apex, reflexed after anthesis; stamens 20, filaments often

persistent on the ripe fruit; anthers pink; styles 3-5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening at the end of September, on slender reddish pedicels, in few-fruited erect clusters, short-oblong to obovate, orange-red, lustrous, marked by large pale lenticels, about 1 cm long and 8-10 mm wide; calyx little enlarged, with a narrow deep cavity, and closely appressed lobes dark red on the upper side below the middle; flesh thin, yellow-green, dry and mealy; nutlets usually 4, narrowed and acute at the ends or rounded at the base, rounded or ridged on the back, with a low broad ridge, light colored, 7-8 mm long, and about 4 mm wide.

A shrub 4-5 m high, with crowded slender fastigiate light gray branches, the lower spreading, the upper ascending, and stout only slightly zigzag glabrous branchlets light orange-green when they first appear, becoming dull olive-brown and marked by small dark lenticels in their first season and dull gray-brown the following year, and armed with few stout nearly straight dull dark chestnut-brown spines 2.5-3 cm in length.

Buffalo, J. Dunbar (*41, type), May 28, June 12 and September 26, 1905.

***Crataegus dunbari* Sargent**

Rochester Acad. Sci. Proc. IV. 126 (1903).

Buffalo, J. Dunbar (*43), September 26, 1905, May 28, 1906; also near Rochester, New York.

***Crataegus asperifolia* Sargent**

Rhodora III. 31 (1901). Sargent and Peck, N. Y. State Mus. Bul. 105. 64 (1906).

Buffalo, J. Dunbar (*13), September 29, 1903, June 1 and September 20, 1904; (*46), May 28, 1906; (*43), September 26, 1905, May 28, 1906; also near Albany, New York and in western New England.

***Crataegus scabrida* Sargent**

Rhodora III. 29 (1901); Silva N. Am. XIII. 133, t. 677.

Belfast, Allegany co., Baxter and Dewing (*210), May 29 and September 17, 1903, September 13, 1904, May 29 and September 19, 1905; also in western New England.

2 NUTLETS WITH LONGITUDINAL CAVITIES ON THE VENTRAL FACES

X TOMENTOSAE

Fruit pyriform to subglobose or short-oblong, 1-1.5 cm in diameter, lustrous, orange or scarlet; nutlets 2 or 3, usually obtuse at the ends and prominently ridged on the back.

Leaves thin, with midribs and veins only slightly impressed on their upper surface; fruit obovate to short-oblong.

Stamens 20

- Anthers yellow.....1 *C. structilis*
 Anthers pink.....2 *C. finitima*
 Stamens 10; anthers yellow 3 *C. venustula*

Leaves thick to subcoriaceous or coriaceous on vigorous shoots, with midribs and veins deeply impressed on their upper surface; fruit subglobose to short-oblong or ovate, scarlet.

Stamens 20

- Anthers pink; leaves nearly glabrous at maturity; pedicels slender
 Leaves ovate to obovate; flowers 1-1.2 cm in diameter, on slightly villose pedicels.....4 *C. succulenta*
 Leaves oblong-ovate to oval, 1.6-1.8 cm in diameter, on densely villose pedicels.....5 *C. admiranda*
 Anthers rose color; leaves rhombic to oval or ovate, pubescent below at maturity; flowers on stout densely villose pedicels.....6 *C. calvini*

Stamens 10; anthers yellow

- Leaves rhombic to oval or obovate; flowers on short pedicels, in compact corymbs; calyx-lobes densely villose on the inner surface; fruit at least 1.2 cm in diameter, in drooping clusters; spines stout, nearly straight 7 *C. ferentaria*
 Leaves broadly obovate to elliptic; flowers on long slender pedicels, in wide corymbs; calyx-lobes only slightly villose on the inner surface; fruit only 7-8 mm in diameter, in erect clusters; spines long, slender, usually curved.....8 *C. macracantha*

Crataegus structilis Ashe

Jour. Elisha Mitchell Sci. Soc. XIX. 12 (1903). Gruber, Bucks County (Penn.) Nat. Sci. Club Proc. 1. 3. Sargent, Acad. Sci. Phila. Proc. 656 (1905).

Seneca park, Rochester, B. H. Slavin, 1906; also in eastern Pennsylvania and in Ontario and southern Michigan.

***Crataegus finitima* n. sp.**

Leaves rhombic to oblong-ovate, acuminate and long-pointed at the apex, gradually narrowed and concave-cuneate at the acuminate entire base, sharply doubly serrate above, with straight glandular teeth, and divided above the middle into 4 or 5 pairs of small acuminate lobes; nearly fully grown when the flowers open about the 20th of May and then membranaceous, bright yellow-green, scabrous and sparingly villose along the midribs above and pale and slightly villose below, and at maturity thin but firm in texture, light green, smooth, lustrous and glabrous on the upper surface, and pale blue-green and villose-pubescent on the lower surface especially on the slender yellow midribs and thin pale primary veins extending very obliquely to the points of the lobes, 7.5-9 cm long and 4.5-5 cm wide; petioles slender, broadly wing-margined at the apex, villose on the upper side while young, soon glabrous, occasionally glandular early in the season, with minute glands, often rose color in the autumn, 2-3 cm in length; stipules linear, only slightly glandular, fading rose color, caducous; leaves on vigorous shoots sometimes obovate and rounded at the apex, more coarsely serrate and 8-9 cm long and 6-7 cm wide. Flowers 1.6 cm in diameter, on slender pedicels thickly covered with matted pale hairs, in wide villose 20-30-flowered corymbs, the lower peduncles from the axils of upper leaves, their bracts and bractlets linear, glandular, fading brown, caducous; calyx-tube narrowly obconic, covered with long white hairs, the lobes long, slender, acuminate, minutely glandular serrate below the middle, slightly villose on both surfaces, reflexed after anthesis; stamens 20; anthers pink; styles 2 or 3, surmounted at the base by a narrow ring of pale tomentum. Fruit ripening about the first of October, on short erect reddish pedicels in many-fruited clusters, short-oblong to subglobose, full and rounded at the ends, orange-red, lustrous, marked by large pale dots, about 1 cm in diameter; calyx prominent, with a narrow shallow cavity, and elongated spreading narrow coarsely serrate lobes red toward the base and puberulous on the upper surface; flesh thick, yellow, sweet and succulent; nutlets 2 or 3, broad, rounded at the ends, ridged on the back, with a low narrow ridge, penetrated on the inner face by broad deep cavities, about 6 mm long, and 4 mm wide.

A tree or arborescent shrub 6-7 m high, sometimes with a trunk 2-2.5 dm in diameter and 2 m long covered with dark bark divided into narrow ridges, large spreading branches, and stout slightly

zigzag glabrous branches light orange-green when they first appear, becoming bright chestnut-brown, very lustrous and marked by oblong pale lenticels in their first season and dull red-brown the following year, and armed with many stout slightly curved chestnut-brown or purplish shining spines 6–8 cm long and often pointing toward the base of the branch, persistent and branched on old stems.

Niagara Falls, C. S. Sargent (✱ 6, type), September 19, 1901, J. Dunbar, May 22, 1903, September 29, 1904, May 28, 1906.

***Crataegus venustula* n. sp.**

Leaves oblong-ovate, acuminate, sharply or abruptly concave-cuneate at the entire base, coarsely doubly serrate above, with straight glandular teeth, and divided into 5 or 6 pairs of small acuminate spreading lateral lobes; nearly fully grown when the flowers open during the last week of May and then membranaceous, dark yellow-green and roughened above by short white hairs, and pale and slightly villose along the midribs below, and at maturity thin but firm in texture, dark green, smooth and lustrous on the upper surface, pale yellow-green on the lower surface, 5–7 cm long and 3.5–4.5 cm wide, with slender dark yellow midribs, and thin primary veins arching obliquely to the points of the lobes; petioles slender, wing-margined at the apex, sparingly glandular while young, villose on the upper side early in the season, soon glabrous, 2–2.5 cm in length; leaves on vigorous shoots broadly ovate to oval, mostly rounded at the base and often 8–9 cm long and 7–8 cm wide, with stout broadly winged glandular petioles. Flowers on slender glabrous pedicels, in wide usually 15–20-flowered thin-branched corymbs; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate, coarsely glandular serrate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 10; anthers pale yellow; styles 2 or 3, surrounded at the base by a narrow ring of white tomentum. Fruit ripening early in October, on stout erect red pedicels, in drooping many-fruited clusters, subglobose, often slightly broader than high, crimson, lustrous, marked by large pale dots, about 1 cm in diameter; calyx prominent, with a broad deep cavity, and long closely appressed coarsely serrate persistent lobes villose on the upper side and red toward the base; flesh thick, yellow, sweet and succulent; nutlets 2 or 3, broad and rounded at the ends, rounded and ridged on the back, with a broad low grooved ridge, penetrated on the inner faces by deep cavities, 6–7 mm long, and about 4 mm wide.

A shrub 3-4 m high, with slender erect stems covered with dark scaly bark, small erect branches, and thin nearly straight branchlets light olive-green and lustrous in their first season and dull gray-brown the following year, and armed with stout straight or slightly curved light chestnut-brown shining spines 3-3.5 cm in length.

Niagara Falls, J. Dunbar (*14, type), June 1, 1904, May 28, 1906, J. Dunbar and C. S. Sargent, September 16, 1904.

***Crataegus succulenta* Link**

Handbook II. 76 (1831). Sargent, Silva N. Am. XIII. 139, t. 131; Rochester Acad. Sci. Proc. IV. 133; Man. 497, f. 411; Acad. Sci. Phila. Proc. 675 (1905). Sargent & Peck, N. Y. State Mus. Bul. 105. 72 (1906).

Buffalo, J. Dunbar (*21), September 29, 1903, September 20, 1904, June 12, 1905; Niagara Falls, J. Dunbar (*29), June 12 and September 27, 1905, J. Dunbar (*7), May 22 and September 29, 1903; also eastern New York to southern New England and Michigan.

***Crataegus admiranda* n. sp.**

Leaves oblong-obovate to oval, acute or acuminate at the apex, concave-cuneate and gradually narrowed to the long entire base, finely doubly serrate above, with straight glandular teeth, and very slightly divided above the middle into 4 or 5 pairs of small acuminate spreading lobes; nearly half grown when the flowers open during the first week of June and then thin, yellow-green, lustrous and roughened above by short white hairs and pale and villose below especially along the midribs and veins, and at maturity dark yellow-green, lustrous, smooth and glabrous on the upper surface, pale and almost glabrous on the lower surface, 6-8 cm long and 4-5 cm wide, with stout midribs often rose color in the autumn, and slender primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined sometimes to the middle, villose on the upper side while young, becoming almost glabrous, usually rose color in the autumn, 1.5-1.8 cm in length; leaves on vigorous shoots subcoriaceous, broadly ovate to oval, gradually narrowed and rounded at the base, more coarsely serrate, often 7-8 cm long and 6-7 cm wide. Flowers 1.6-1.8 cm in diameter, on long slender pedicels coated with matted pale hairs, in wide usually 18-20-flowered hairy corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, densely villose, the lobes slender, acuminate, coarsely glandular serrate, villose on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens

20; anthers pale pink; styles 2 or 3. Fruit ripening early in October, on stout villose erect or spreading reddish pedicels, in few-fruited clusters, subglobose to short-oblong or ovate, bright cherry-red, lustrous, marked by pale dots, 1.2-1.4 cm in diameter; calyx little enlarged, with a deep narrow cavity, and spreading and appressed lobes often deciduous from the ripe fruit; flesh yellow, soft and succulent; nutlets 2 or 3, gradually narrowed and rounded at the ends, ridged on the back, with a broad slightly grooved ridge, penetrated on the inner surface by large shallow cavities, 7-8 mm long, and 5-6 mm wide.

An arborescent shrub 3-4 m high, with stems covered with dark gray bark, spreading branches forming a round-topped open head, and stout nearly straight branchlets, light orange-green, slightly hairy and marked by large lenticels when they first appear, becoming light red-brown and lustrous in their first season and dull dark reddish brown the following year and armed with stout nearly straight chestnut-brown or purplish shining spines 5-6 cm long, becoming branched and very abundant on old stems.

Niagara Falls, J. Dunbar (*2), October 7, 1902, June 7 and September 18, 1906.

***Crataegus calvini* n. sp.**

Leaves rhombic to oval or ovate, acuminate or acute at the apex, gradually narrowed and concave-cuneate or rounded at the entire base, coarsely doubly serrate above, with straight glandular teeth, and very slightly divided above the middle into 4 or 5 pairs of small acuminate lobes; more than half grown when the flowers open about the first of June and then thin, yellow-green and slightly roughened above by short white hairs and pale and pubescent below, and at maturity subcoriaceous, dark green, smooth, glabrous and lustrous on the upper surface, paler and pubescent on the lower surface principally on the stout rose colored midribs and slender primary veins extending obliquely to the points of the lobes, 5-7 cm long and 4-5 cm wide; petioles stout, narrowly wing-margined sometimes to the middle, villose-pubescent on the upper side while young, becoming glabrous, rose colored in the autumn, 1-1.5 cm in length; leaves on vigorous shoots broadly ovate to oval or rarely obovate, short-pointed and acute at the apex, more coarsely serrate, often 9-10 cm long and 7-8 cm wide. Flowers 1.2-1.5 cm in diameter, on short stout densely villose pubescent pedicels, in broad many-flowered thick-branched hairy corymbs, with foliaceous

oblong-obovate acuminate glandular serrate bracts and bractlets fading brown and persistent until the flowers open, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, thickly coated with matted pale hairs, the lobes abruptly narrowed from broad bases, wide, acuminate, laciniately glandular serrate, sparingly hairy toward the base on the outer surface, slightly villose on the inner surface, reflexed after anthesis; stamens 20; filaments often persistent on the ripe fruit; anthers light rose color; styles 2, surrounded at the base by a broad ring of tomentum. Fruit ripening late in September, on slender reddish hairy pedicels, in wide lax many-fruited drooping clusters, oval to ovate, full and rounded at the ends, scarlet, lustrous, marked by large pale dots; calyx prominent, with a wide deep cavity, and closely appressed persistent lobes dark red above at the base and villose on the upper surface; flesh thin, yellow, sweet and succulent; nutlets 2, full and rounded at the base, narrow and rounded at the apex, slightly ridged on the back, with a narrow grooved ridge, deeply penetrated on the inner face by long wide cavities, about 7 mm long, and 4 mm wide.

A shrub 2.5-3 m high, with numerous stems covered with dark gray bark, spreading branches, stout zigzag glabrous branchlets light yellow-green when they first appear, becoming bright chestnut-brown, very lustrous and marked by large pale lenticels in their first season and dull red-brown the following year, and armed with nearly straight stout or slender purplish shining spines 3-4 cm long.

Rich alluvial soil, near Canandaigua, Ontario co., C. C. Laney (* A. type), October 14, 1901, C. S. Sargent, October 1, 1902, M. S. Baxter, May 30 and September 20, 1903.

This handsome species is named for Mr Calvin Cook Laney, superintendent of the parks of the city of Rochester, New York, a keen and enthusiastic student of *Crataegus*, by whom it was first noticed in 1901.

***Crataegus ferentaria* Sargent**

Rochester Acad. Sci. Proc. IV. 135 (1903); *Rhodora* VII. 184.

Buffalo, J. Dunbar (* 15), June 1, 1904, May 28 and June 12, 1905; also near Rochester and Utica, New York and eastward to New England,

Crataegus macracantha Koehne

Deutsche Dendr. 236 (1893). Sargent, Silva N. Am. XIII. 147, t. 689;
Rochester Acad. Sci. Proc. IV. 135; Man. 501, f. 415.

Crataegus glandulosa macracantha Lindley, Bot. Reg. XXII.
t. 1912 (1836).

Crataegus coccinea var. *macracantha* Dudley, Cornell Univ.
Bul. II. 33 (1886).

Niagara Falls, J. Dunbar (*28), June 12 and September 28,
1905; also near Rochester, New York and eastward to New
England.

NOTES ON A COLLECTION OF CRATAEGUS MADE BY
MR G. D. CORNELL IN THE NEIGHBORHOOD OF
COOPERS PLAINS, STEUBEN COUNTY, NEW YORK.

BY C. S. SARGENT

PUNCTATAE

Crataegus desueta n. sp.

Leaves rhombic to slightly obovate, acuminate at the ends, finely doubly serrate, with straight glandular teeth, and divided above the middle into 5 or 6 pairs of slender acuminate spreading or recurved lobes; when they unfold tinged with red and covered on the upper surface with long soft white hairs, more than half grown when the flowers open about the middle of May and then very thin, light yellow-green and nearly glabrous above and pale and glabrous below, and at maturity thin but firm in texture, dark yellow-green, smooth, glabrous and lustrous on the upper surface, pale yellow-green on the lower surface, 5-6 cm long and 3-4 cm wide, with slender prominent yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly hairy on the upper surface, 1.5-2.5 cm in length; leaves on vigorous shoots oval to obovate, usually abruptly long-pointed at the apex, concave-cuneate at the base, more coarsely serrate, more deeply lobed and often 6-7 cm long and 4.5-5 cm wide. Flowers about 1.5 cm in diameter, on slender slightly villose pedicels, in lax mostly 8-10-flowered corymbs, the much elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate, entire or occasionally glandular dentate near the base, glabrous, reflexed after anthesis; stamens 10; anthers rose color; styles 2-4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening late in September, on long slender glabrous or slightly hairy drooping pedicels, in few-fruited clusters, short-oblong full and rounded at the ends, scarlet, lustrous, marked by small pale dots, 1-1.2 cm long, 8-10 mm in diameter; calyx prominent, with a deep narrow cavity, and much elongated erect and incurved nearly entire persistent lobes dark red on the upper side below the middle; flesh thin, dark yellow, dry and mealy; nutlets usually 3 or 4, narrowed and acute at the ends or rounded at the apex, rounded and only slightly grooved on the back, 6.5-7 mm long, and 4-4.5 mm wide.

A shrub not more than 4 m high, with numerous small erect or slightly spreading stems covered with dark gray bark, small ascending branches and slender nearly straight glabrous branchlets, dark orange-green and marked by pale lenticels when they first appear, becoming bright chestnut-brown in their first season and dull gray-brown the following year, and armed with slender nearly straight chestnut-brown shining spines 4.5-5.5 cm long, and often persistent and becoming stout and dark gray on old stems.

Rich moist hillsides, Coopers Plains, G. D. Cornell (* 23, type), September 21, 1905, May 27 and September 24, 1906, (* 23A), September 23, 1905, May 17, 1906, (* 9), September 17, 1905, May 28, 1906.

PRUINOSAE

Stamens 20

Anthers rose color or pink

***Crataegus beata* Sargent**

Rochester Acad. Sci. Proc. IV. 97 (1903).

Hillsides, Coopers Plains, G. D. Cornell (* 102), September 1906, June 1907; also valley of the Genesee river, New York.

***Crataegus arcana* Beadle**

Bilt. Bot. Studies I. 122 (1902). Sargent, Bot. Gazette XXXV. 101; Acad. Sci. Phila. Proc. 588 (1905).

Rich hillsides, Coopers Plains, G. D. Cornell (* 28), September 30, 1906, May 25 and October 28, 1907; also Niagara Falls, New York and eastern Pennsylvania to western North Carolina.

***Crataegus pellecta* n. sp.**

Glabrous with the exception of the hairs on the upper side of the young leaves and petioles. Leaves ovate, acuminate, rounded or abruptly cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and slightly divided above the middle into 3 or 4 pairs of small spreading acuminate lobes; about half grown when the flowers open at the end of May or early in June and then thin, light yellow-green above and slightly hairy along the upper side of the midribs and paler below, and at maturity thin, dull bluish green, 5-6 cm long and 3.5-4.5 cm wide, with thin prominent midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly villose on the upper side while

young, 2.5-3 cm in length; leaves on vigorous shoots broadly ovate, usually rounded at the base, more deeply lobed, and often 5-6 cm long and wide. Flowers 2-2.4 cm in diameter, on long slender pedicels, in mostly 4-10-flowered lax corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, short, acuminate, entire or occasionally dentate near the middle, reflexed after anthesis; stamens 20; anthers faintly tinged with pink; styles 3-5. Fruit ripening at the end of October, on stout erect pedicels, in few-fruited clusters, short-oblong to subglobose or often rather broader than long, slightly angled toward the base, dark red, pruinose, 1.2-1.4 cm in diameter; calyx prominent, with a broad deep cavity tomentose in the bottom, and small spreading persistent lobes; flesh thin, tinged with red, dry and mealy; nutlets 3-5, acute at the ends or rounded at the apex, rounded and slightly grooved on the back, 6.5-7 mm long, and about 5 mm wide.

A shrub sometimes 3-4 m high, with numerous small stems, ascending branches, and slender nearly straight branchlets dark orange-green tinged with red when they first appear, becoming dark chestnut-brown, lustrous and marked by small dark lenticels in their first season and dull reddish brown the following year, and armed with stout slightly curved bright chestnut-brown shining spines 3-4 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (✱ 86, type), October 20, 1906, June 8, 1907.

***Crataegus amoena* Sargent**

Rich hillsides, Coopers Plains, G. D. Cornell (✱ 97), October 28, 1906, June 5, 1907; (✱ 38), October 1, 1905, June 2, 1907; (✱ 89), October 28, 1906, June 8, 1907; also at Niagara Falls, New York.

***Crataegus gracilis* Sargent**

Rich hillsides, Coopers Plains, G. D. Cornell (✱ 40), May 26, 1906, June 1907.

***Crataegus ramosa* n. sp.**

Glabrous with the exception of the hairs on the young leaves. Leaves oblong-ovate, acuminate, rounded or abruptly cuneate at the broad base, finely doubly serrate, and divided into 3 or 4 pairs of short broad acuminate lobes; when they unfold deeply tinged with red, villous above and furnished below with axillary tufts of

short hairs; more than half grown when the flowers open at the end of May or early in June and then thin, yellow-green, glabrous and paler below than above, and at maturity thin but firm in texture, dark yellow-green, smooth and lustrous on the upper surface, paler on the lower surface, 4.5-6 cm long and 3.5-5 cm wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, conspicuously glandular while young, with usually deciduous glands, 2-2.5 cm long; leaves on vigorous shoots subcoriaceous, ovate, acuminate, rounded or slightly cordate at the base, coarsely serrate, deeply lobed, often 7-8 cm long and wide, with stout broad-winged coarsely glandular petioles, and linear falcate glandular caducous stipules. Flowers 2-2.8 cm in diameter, on long slender pedicels, in 5-8-flowered compact corymbs, with linear-obovate to linear bracts and bractlets fading brown and often persistent until the flowers open, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, long, slender, acuminate, red and glandular at the apex, entire or irregularly glandular dentate, reflexed after anthesis; stamens 20; anthers pink; styles 3-5, surmounted at the base by a narrow ring of pale tomentum. Fruit on long slender drooping red pedicels, in few-fruited clusters, ripening and falling at the end of October, short-oblong to oval, full and rounded at the ends, red, pruinose, becoming lustrous, marked by large dots, 1.2-1.3 cm long, 1-1.1 cm in diameter; calyx prominent, with a short tube, a wide deep cavity, broad and tomentose in the bottom, and small spreading persistent lobes; flesh green, dry and hard; nutlets 3-5, narrowed and acute at the ends or rounded at the base, ridged on the back, with a high narrow slightly grooved ridge, 7-7.5 mm long, and 4-4.5 mm wide.

A shrub 3 m high, with small intricately branched stems covered with light gray bark, small ascending branches forming a compact round-topped head, and stout straight or slightly zigzag branchlets deeply tinged with red when they first appear, becoming light chestnut-brown, lustrous and marked by numerous small dark lenticels in their first season and pale gray-brown the following year, and armed with slender straight light chestnut-brown shining spines 3.5-4 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (* 98, type), October 21, 1906, June 5, 1907.

Anthers yellow

***Crataegus cognata* Sargent**

Rhodora V. 58 (1903).

Hillsides, Coopers Plains, G. D. Cornell (* 6, 43 and 103), September and October 1905, May 1906; also southern Ontario, through western New York to western and southern New England.

***Crataegus rubro-lutea* n. sp.**

Glabrous with the exception of the hairs on the young leaves. Leaves ovate to oval, acuminate, rounded or cuncate at the entire base, finely doubly serrate above, with straight or incurved glandular teeth, and slightly divided above the middle into 3 or 4 small acuminate spreading lobes; bronze color and roughened above by short white hairs and furnished below with axillary tufts of hairs when they unfold, more than half grown when the flowers open late in May or early in June and then thin, yellow-green, nearly glabrous and paler below than above, and at maturity thin but firm in texture, dull yellow-green, smooth and glabrous on the upper surface, pale yellow-green on the lower surface, 4-5 cm long and 3.5-4 cm wide, with prominent yellow midribs, and primary veins still furnished with a few axillary hairs; petioles slender, slightly wing-margined at the apex, glandular with small dark often persistent glands, 1.5-2 cm in length; stipules linear, green, glandular-serrate, caducous; leaves on vigorous shoots subcoriaceous, ovate, rounded or subcordate at the broad base, often 4.5-5.5 cm long and wide and often broader than long. Flowers 1.8-2.2 cm in diameter, on long slender pedicels, in wide, lax, mostly 6-10-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, wide, short, acuminate and glandular at the apex, entire or minutely glandular dentate, reflexed after anthesis; stamens 20; anthers pale yellow; styles 4 or 5. Fruit on long slender red drooping pedicels, in few-fruited clusters, ripening and falling from the middle to the end of October, subglobose and often broader than high, or obovate and abruptly narrowed at the base, slightly angled, light orange-red, lustrous, marked by large dark dots, 1.2-1.5 cm in diameter; calyx prominent, with a short tube, a broad deep cavity tomentose in the bottom, and small spreading slightly incurved appressed lobes; flesh hard, mealy, light orange-red; nutlets 4 or 5, narrowed and acute at the ends, ridged on the back, with a high narrow often deeply grooved ridge, 6-6.5 mm long, and 4-4.5 mm wide.

A shrub 3-4 m high, with numerous small stems covered with dark gray bark, spreading and ascending branches forming an open head, and slender nearly straight branchlets, light green when they first appear, becoming light chestnut-brown, lustrous and marked by small dark lenticels in their first season and dull red-brown the following year, and armed with numerous stout or slender, straight or slightly curved chestnut-brown shining spines 1-1.5 cm long.

Hillsides, Coopers Plains, G. D. Cornell (* 96, type), October 21, 1906, June 5, 1907.

Stamens 15-20; anthers pale rose color.

***Crataegus macrocalyx* n. sp.**

Glabrous with the exception of the hairs on the young leaves. Leaves ovate, acuminate, rounded or cuneate at the base, finely and often doubly serrate above, with straight glandular teeth, and divided into 4 or 5 pairs of short broad acuminate spreading lobes; sometimes deeply 3-lobed on stump shoots; tinged with red and setose above when they unfold, nearly fully grown when the flowers open late in May and then very thin, yellow-green and nearly glabrous, and at maturity thin, yellow-green and scabrate on the upper surface, pale bluish green on the lower surface, 5-6 cm long and 4.5-5 cm wide, with thin rose colored midribs and primary veins; petioles slender, slightly wing-margined at the apex, glandular, with minute often persistent glands, 2-3 cm in length; stipules linear to linear-falcate, acuminate, glandular, fading brown, caducous. Flowers 1.8-2.5 cm in diameter, on long slender pedicels, in narrow mostly 5-7-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes separated by wide sinuses, gradually narrowed from the base, short, slender and glandular at the apex, entire or occasionally dentate, reflexed after anthesis; stamens 15-20; anthers pale rose color; styles 3 or 4, surrounded at the base by a narrow ring of pale hairs. Fruit ripening the end of October, on slender spreading red pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, slightly angled, red, pruinose, marked by small pale dots, 1-1.2 cm in diameter; calyx very prominent, with a broad deep cavity narrow and tomentose in the bottom, and spreading lobes dark red on the upper side below the middle; flesh green, dry and mealy; nutlets 3 or 4, acute at the ends, rounded and slightly grooved or irregularly ridged on the back, 6.5-7 mm long, and 4-4.5 mm wide.



lobes; flesh thick, deeply tinged with red; nutlets 4 or 5, acute at the base, abruptly narrowed and rounded or acute at the apex, rounded and grooved or irregularly ridged on the back, about 7 mm long, and 3.5-4 mm wide.

A shrub 3-4 m high, with stems covered with dark gray-brown bark, ascending branches and stout nearly straight branchlets dark orange-green and marked by large pale lenticels when they first appear, becoming dark chestnut-brown and lustrous in their first season and dull gray-brown the following year, and armed with stout straight purplish shining spines 3.5-4 cm long.

Hillsides, Coopers Plains, G. D. Cornell (*61, type), May 26 and September 21, 1906.

***Crataegus plana* Sargent**

Hillsides, Coopers Plains, G. D. Cornell (*2), September 30, 1905, May 25, 1906, (*36), October 1, 1905, May 26, 1906, (*101), September 21, 1906, June 5, 1907; also in the Genesee valley and near Buffalo, New York.

***Crataegus dissona* Sargent**

Rhodora V. 60 (1903); *Bot. Gazette* XXXV. 379; *Acad. Sci. Phila. Proc.* 601 (1905).

Coopers Plains, G. D. Cornell (*4), October 8, 1905, May and October 1906 (*53), October 1, 1905, May 26, 1906; also Illinois to western and southern New England and to eastern Pennsylvania.

Leaves scabrate

***Crataegus ovatifolia* n. sp.**

Leaves ovate, long-pointed and acuminate at the apex, gradually or abruptly narrowed and concave-cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided above the middle into 3 or 4 pairs of narrow acuminate spreading lobes; deeply tinged with red and covered by soft white hairs on the upper surface when they unfold, about half grown when the flowers open at the end of May and then very thin, yellow-green above and glabrous below, and at maturity thin, dark yellow-green, slightly hairy and scabrate on the upper surface, pale bluish green on the lower surface, 4-5 cm long and 3-3.5 cm wide, with thin midribs and primary veins; petioles very slender, slightly wing-margined at the apex, sparingly villose on the upper side while

young, soon becoming glabrous, glandular, with minute generally deciduous glands, 2-2.5 cm in length; leaves on vigorous shoots thicker, rounded or abruptly cuneate at the base, more coarsely serrate and more deeply lobed, often 6 cm long and 4-4.5 cm wide. Flowers 1.7-2 cm in diameter, on long slender glabrous pedicels, in compact mostly 5-10-flowered corymbs, the lower peduncles from the axils of the upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from wide bases, long, slender, acuminate, entire or minutely glandular serrate, glabrous, reflexed after anthesis; stamens 10; anthers red; styles 3 or 4, surrounded at the base by a narrow ring of pale hairs. Fruit ripening late in October and often persistent during the winter, on slender drooping reddish pedicels, in few-fruited clusters, obovate, full and rounded at the apex, gradually narrowed at the base, scarlet, pruinose, marked by large dark dots, 1-1.2 cm long, 8-10 mm in diameter; calyx prominent, with a broad deep cavity wide and tomentose in the bottom, and spreading persistent lobes dark red on the upper side below the middle; flesh thin, greenish yellow, rather juicy; nutlets 3 or 4, acute at the ends, ridged on the back, with a broad low grooved ridge, 6-6.5 mm long, and 4-4.5 mm wide.

A shrub 3-4 m high, with numerous small stems covered with ashy gray bark and often spreading into large thickets, ascending branches, and slender nearly straight branchlets dark orange-green and marked by pale lenticels when they first appear, becoming bright chestnut-brown and lustrous in their first season and dull red-brown the following year, and armed with slender straight or slightly curved dark chestnut-brown shining spines 3-4.5 cm long, often persistent and becoming compound on old stems.

Coopers Plains, G. D. Cornell (*1, type), September 21, 1905, May 27, 1906 (*24), May 24 and September 21, 1905 (*33), October 1906, May 1907.

***Crataegus barryana* Sargent**

Hillsides, Coopers Plains, G. D. Cornell (*27), September 21, 1905, May 25 and October 14, 1906, May and October 1907; also near Rochester, New York.

***Crataegus acerba* n. sp.**

Leaves ovate to rhombic, acuminate at the apex, cuneate at the entire base, sharply often doubly serrate above, with straight or

lobes; flesh thick, deeply tinged with red; nutlets 4 or 5, acute at the base, abruptly narrowed and rounded or acute at the apex, rounded and grooved or irregularly ridged on the back, about 7 mm long, and 3.5-4 mm wide.

A shrub 3-4 m high, with stems covered with dark gray-brown bark, ascending branches and stout nearly straight branchlets dark orange-green and marked by large pale lenticels when they first appear, becoming dark chestnut-brown and lustrous in their first season and dull gray-brown the following year, and armed with stout straight purplish shining spines 3.5-4 cm long.

Hillsides, Coopers Plains, G. D. Cornell (*61, type), May 26 and September 21, 1906.

Crataegus plana Sargent

Hillsides, Coopers Plains, G. D. Cornell (*2), September 30, 1905, May 25, 1906, (*36), October 1, 1905, May 26, 1906, (*101), September 21, 1906, June 5, 1907; also in the Genesee valley and near Buffalo, New York.

Crataegus dissona Sargent

Rhodora V. 60 (1903); Bot. Gazette XXXV. 379; Acad. Sci. Phila. Proc. 601 (1905).

Coopers Plains, G. D. Cornell (*4), October 8, 1905, May and October 1906 (*53), October 1, 1905, May 26, 1906; also Illinois to western and southern New England and to eastern Pennsylvania.

Leaves scabrate

Crataegus ovatifolia n. sp.

Leaves ovate, long-pointed and acuminate at the apex, gradually or abruptly narrowed and concave-cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided above the middle into 3 or 4 pairs of narrow acuminate spreading lobes; deeply tinged with red and covered by soft white hairs on the upper surface when they unfold, about half grown when the flowers open at the end of May and then very thin, yellow-green above and glabrous below, and at maturity thin, dark yellow-green, slightly hairy and scabrate on the upper surface, pale bluish green on the lower surface, 4-5 cm long and 3-3.5 cm wide, with thin midribs and primary veins; petioles very slender, slightly wing-margined at the apex, sparingly villose on the upper side while

***Crataegus dissociabilis* n. sp.**

Leaves broadly ovate to triangular, acuminate, rounded, truncate or abruptly cuneate at the wide entire base, finely often doubly serrate above, with small glandular teeth, and slightly divided usually only above the middle into 3 or 4 pairs of small acuminate lobes; when they unfold deeply tinged with red and covered on the upper surface with soft white hairs and slightly hairy in the axils of the veins below, nearly fully grown when the flowers open late in May or early in June, and then thin, light yellow-green, scabrate and slightly hairy on the midribs above, and at maturity thin, yellow-green, slightly roughened and lustrous on the upper surface, pale bluish green on the lower surface, 3.5-4 cm long and 3-4 cm wide, with thin midribs, and primary veins arching obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, glandular while young, with mostly deciduous glands, 1.5-3 cm in length. Flowers 1.5-2 cm in diameter, on slender glabrous pedicels, in compact mostly 5-10-flowered corymbs, with linear-obovate to linear glandular bracts and bractlets fading brown and deciduous before the flowers open, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from the base, slender, glabrous, red and glandular at the acuminate apex, irregularly and coarsely glandular serrate usually only below the middle, reflexed after anthesis; stamens 5-10; anthers pale rose color; styles 3 or 4. Fruit ripening and falling late in September, on long slender drooping pedicels, in few-fruited clusters, obovate, full and rounded at the apex, abruptly narrowed at the base, light cherry-red, very pruinose, marked by large pale dots, about 1 cm long and 9 mm in diameter; calyx little enlarged, without a tube, with a wide deep cavity narrow in the bottom, and small spreading lobes dark red on the upper side; flesh pink, sweet and juicy; nutlets 3 or 4, acute or acuminate at the base, gradually narrowed and rounded at the apex, ridged on the back, with a broad deeply grooved ridge, 6-7 mm long, and 4-4.5 mm wide.

An arborescent shrub 3-4 m high, with a short stem sometimes 1.5 dm in diameter, covered near the ground with dark scaly bark, small ascending and spreading branches, and slender nearly straight glabrous-branchlets, dark orange-green tinged with red when they first appear, becoming dark chestnut-brown, lustrous and marked by pale lenticels in their first season and dull red-brown the follow-

ing year, and armed with slender slightly curved purple shining spines 2.5-4 cm long.

Coopers Plains, G. D. Cornell (*88, type), September 22, 1906. June 8, 1907.

Anthers pale yellow

***Crataegus inusitula* Sargent**

Rich hillsides, Coopers Plains, G. D. Cornell (*57), May 26 and October 14, 1906, May and September 1907; also at Chapinville, Ontario co.

The Coopers Plains plant differs from the type of *Crataegus inusitula* in the fewer hairs on the pedicels, which are sometimes nearly glabrous.

TENUIFOLIAE

Stamens 10 or less; anthers rose color, red or pink

***Crataegus ignea* n. sp.**

Glabrous with the exception of the hairs on the upper surface of the young leaves and calyx-lobes. Leaves oblong-ovate, long-pointed and acuminate at the apex, rounded or abruptly concave-cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of small acuminate spreading lateral lobes; deeply tinged with red and covered on the upper surface with soft white hairs when they unfold, more than half grown when the flowers open at the end of May or early in June, and then thin, yellow-green, still slightly hairy above and pale below, and at maturity thin but firm in texture, dull yellow-green and slightly roughened on the upper surface, pale yellow-green on the lower surface, 4-5 cm long and 2.5-4 cm wide, with thin yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly villose while young, soon becoming glabrous, occasionally glandular, often dark rose color in the autumn, 1.5-2.5 cm in length; stipules linear to lanceolate, glandular, with bright red glands, green, caducous; leaves on vigorous shoots thick, ovate, acute, rounded, truncate or subcordate at the broad base, more coarsely serrate, more deeply lobed, and often 6-7 cm long and 5-6 cm wide, with thick conspicuously glandular petioles. Flowers 1.5-1.7 cm in diameter, on long slender pedicels in compact mostly 6-12-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes slender, red and acuminate at the apex, very

minutely glandular serrate or entire, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 7-10; anthers dark rose color; styles 2-4, usually 3. Fruit ripening at the end of September, on slender drooping or spreading reddish pedicels, in few-fruited clusters, short-oblong, truncate at the ends, scarlet, lustrous, marked by small pale dots, about 1 cm long and 8-9 mm in diameter; calyx little enlarged, with a deep narrow cavity, and spreading slightly incurved persistent lobes; flesh thick, pale yellow; nutlets 3 or 4, narrowed and rounded at the ends, ridged on the back, with a broad low grooved ridge, about 6 mm long, and 4.5-5 mm wide.

A shrub sometimes 3-4 m high, with stems covered with ashy gray bark, ascending branches forming a narrow rather open head, and extremely slender slightly zigzag branchlets deeply tinged with red when they first appear, becoming dark chestnut-brown, lustrous and marked by small pale lenticels in their first season and dull red-brown the following year, and armed with stout straight or slightly curved light chestnut-brown shining spines 2.5-4 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (*83, type), September 22, 1906, June 5, 1907.

Crataegus recta n. sp.

Glabrous with the exception of the hairs on the upper side of the young leaves. Leaves ovate, long-pointed and acuminate at the apex, rounded or abruptly concave-cuneate at the base, finely often doubly serrate, with straight or incurved glandular teeth, and slightly divided into 5 or 6 pairs of small acuminate spreading lobes; deeply tinged with red and roughened on the upper surface by short white hairs when they unfold, more than half grown when the flowers open at the end of May or early in June, and then thin, yellow-green, still slightly hairy especially along the midribs above, and at maturity thin, yellow-green, lustrous and slightly roughened on the upper surface, paler on the lower surface, 5-6 cm long and 3.5-4.5 cm wide, with slender midribs and thin primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, very glandular while young, the glands generally caducous, 1.5-2.5 cm in length; leaves on vigorous shoots coarsely serrate and sometimes 8-9 cm long and 5-6 cm wide, with foliaceous lunate persistent stipules. Flowers 1.5-1.8 cm in diameter on long slender pedicels, in compact mostly 5-12-flowered corymbs, the elongated lower peduncles from the axils of upper

ing year, and armed with slender slightly curved purple shining spines 2.5-4 cm long.

Coopers Plains, G. D. Cornell (*88, type), September 22, 1906, June 8, 1907.

Anthers pale yellow

***Crataegus inusitula* Sargent**

Rich hillsides, Coopers Plains, G. D. Cornell (*57), May 26 and October 14, 1906, May and September 1907; also at Chapinville, Ontario co.

The Coopers Plains plant differs from the type of *Crataegus inusitula* in the fewer hairs on the pedicels, which are sometimes nearly glabrous.

TENUIFOLIAE

Stamens 10 or less; anthers rose color, red or pink

***Crataegus ignea* n. sp.**

Glabrous with the exception of the hairs on the upper surface of the young leaves and calyx-lobes. Leaves oblong-ovate, long-pointed and acuminate at the apex, rounded or abruptly concave-cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of small acuminate spreading lateral lobes; deeply tinged with red and covered on the upper surface with soft white hairs when they unfold, more than half grown when the flowers open at the end of May or early in June, and then thin, yellow-green, still slightly hairy above and pale below, and at maturity thin but firm in texture, dull yellow-green and slightly roughened on the upper surface, pale yellow-green on the lower surface, 4-5 cm long and 2.5-4 cm wide, with thin yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly villose while young, soon becoming glabrous, occasionally glandular, often dark rose color in the autumn, 1.5-2.5 cm in length; stipules linear to lanceolate, glandular, with bright red glands, green, caducous; leaves on vigorous shoots thick, ovate, acute, rounded, truncate or subcordate at the broad base, more coarsely serrate, more deeply lobed, and often 6-7 cm long and 5-6 cm wide, with thick conspicuously glandular petioles. Flowers 1.5-1.7 cm in diameter, on long slender pedicels, in compact mostly 6-12-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes slender, red and acuminate at the apex, very

long, slender, red and glandular at the acuminate apex, entire or minutely glandular dentate, reflexed after anthesis; stamens 8-10; anthers pale rose color; styles 3 or 4. Fruit ripening at the end of September, on long drooping reddish pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, crimson, lustrous, marked by large pale dots, 1-1.1 cm long and 8-9 mm in diameter; calyx little enlarged, with a deep narrow cavity, and spreading often incurved persistent lobes; flesh thin, light yellow; nutlets 2-4, gradually narrowed and rounded or acute at the ends, ridged on the back, with a low grooved ridge, 6-6.5 mm long, and 4-4.5 mm wide.

A shrub 4-5 m high, with stems covered with greenish gray bark, ascending branches, and stout nearly straight branchlets dark orange-green more or less tinged with red when they first appear, becoming dark chestnut-brown, lustrous and marked by pale lenticels in their first season and dull gray-brown the following year, and armed with slender slightly curved dark red-brown shining spines 3-4 cm long.

Hillsides near Coopers Plains, G. D. Cornell (*90, type), September 27, 1906, June 8, 1907.

Crataegus fucata n. sp.

Glabrous with the exception of the hairs on the young leaves and calyx-lobes. Leaves ovate, long-pointed and acuminate at the apex, rounded or abruptly cuneate at the often glandular base, sharply doubly serrate above, with straight glandular teeth, and slightly divided usually only above the middle into 3 or 4 pairs of small acuminate spreading lobes; when they unfold slightly tinged with red, covered above by short white hairs and glabrous below, about a quarter grown when the flowers open in the last week of May and then very thin, light yellow-green and still hairy on the upper surface, and at maturity thin but firm in texture, dark yellow-green and slightly roughened above and pale bluish green below, 5-6 cm long and 4.5-5 cm wide, with thin yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, glandular while young, with mostly deciduous glands, often rose color in the autumn, 2-3 cm in length; leaves on vigorous shoots rounded or subcordate at the base, coarsely serrate, deeply lobed and often 5.5-6 cm long and broad. Flowers about 1.5 cm in diameter, on slender pedicels, in small compact mostly 8-10-flowered corymbs, the lowest peduncle from the axil of an upper leaf; calyx-tube

narrowly obconic, the lobes slender, acuminate, minutely dentate or entire, glabrous on the outer, furnished on the inner surface with occasional hairs, reflexed after anthesis; stamens 5-9; anthers dark rose color; styles 3-5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening and falling late in September, on slender drooping pedicels, in few-fruited clusters, short-oblong to oval, slightly narrowed at the ends, often unsymmetrical and somewhat mammillate at the base, crimson, lustrous, 9-10 mm long and 8-9 mm in diameter; calyx little enlarged, with a wide shallow cavity, and spreading and appressed lobes, red and sparingly villose on the upper side; flesh thin, yellow, slightly tinged with red; nutlets usually 3 or 4, narrowed and rounded at the ends, ridged on the back, with a broad high doubly grooved ridge, 5-6 mm long, and 4-4.5 mm wide.

A shrub 3-4 m high, with ascending and spreading flexuose stems forming a wide open head and covered below with ashy gray bark, small spreading branches, and slender zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming bright chestnut-brown and lustrous in their first season and dull red-brown the following year, and armed with numerous stout straight or slightly curved chestnut-brown shining spines 3.5-4.5 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (*62, type), May 26 and September 21, 1906, May and September 1907.

Crataegus nescia n. sp.

Glabrous with the exception of the hairs on the young leaves and petioles. Leaves ovate, acuminate, cuneate or on vigorous shoots truncate or rounded at the entire base, sharply often doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of narrow acuminate spreading lateral lobes; more than half grown when the flowers open about the 20th of May and then very thin, light yellow-green and roughened above by short white hairs and paler and glabrous below, and at maturity thin, yellow-green, smooth and glabrous on the upper surface, light bluish green on the lower surface, 4-6 cm long and 3.5-5 cm wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly hairy on the upper side while young, soon becoming glabrous, 1.5-2.5 cm in length. Flowers 1.5-1.8 cm in diameter, on long slender pedicels, in small compact mostly 5-12-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-

tube narrowly obconic, the lobes slender, acuminate, entire or minutely glandular dentate near the middle, reflexed after anthesis; stamens 4-8; anthers bright pink; styles 2-4, usually 3, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening and falling early in October, on slender drooping pedicels, in few-fruited clusters, short-oblong to slightly obovate, full and rounded at the ends, scarlet, lustrous, marked by small pale dots, 1-1.2 cm long and 9-10 mm in diameter; calyx little enlarged, with a deep narrow cavity and spreading and appressed or incurved generally persistent lobes dark red on the upper side below the middle; flesh thin, yellow tinged with pink; sweet and juicy; nutlets usually 3, narrowed and rounded at the ends, ridged on the back, with a broad deeply grooved ridge, 5.5-6 mm long, and 4-4.5 mm wide.

A slender shrub 3-4 m high, with stems spreading into small clumps, and covered with light gray bark scaly near the ground, long slender ascending dark greenish branches, and slender wand-like conspicuously zigzag branchlets dark orange-green when they first appear, becoming light chestnut-brown, lustrous, and marked by pale lenticels in their first season and light gray-brown the following year, and armed with stout straight or usually slightly curved chestnut-brown shining spines 2.5-4 cm long.

Rich hillsides, near Coopers Plains, G. D. Cornell (#46, type), May 25 and October 3, 1906.

Crataegus insignata n. sp.

Glabrous with the exception of the hairs on the young leaves. Leaves ovate, acuminate, rounded or abruptly cuneate at the base, finely often doubly serrate, with straight glandular teeth, and slightly divided usually only above the middle into 5 or 6 pairs of narrow acuminate spreading lobes; more than half grown when the flowers open about the 20th of May and then thin, yellow-green and roughened above by short white hairs, and at maturity thin, yellow-green, scabrate on the upper surface, paler on the lower surface, 5-6 cm long and 4.5-6 cm wide, with stout midribs, and thin prominent primary veins extending to the points of the lobes; petioles slender, slightly wing-margined at the apex, 3-3.5 cm in length. Flowers 1.3-1.6 cm in diameter, on short slender pedicels, in compact mostly 6-14-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes long, slender, acuminate, entire or minutely glandular dentate below the middle, reflexed after anthesis; stamens 5-8; anthers pale rose

color; styles 2-5, usually 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening late in October, on short pedicels, in few-fruited drooping clusters, short-oblong, slightly narrowed to the rounded ends, deeply impressed at the insertion of the stalk, dull red, 9-10 mm long, and 8-9 mm in diameter; calyx little enlarged, with a deep narrow cavity tomentose in the bottom, and spreading and appressed lobes, their tips often deciduous from the ripe fruit; flesh thin, orange color, sweet and juicy; nutlets usually 3 or 4, narrowed and rounded at the ends, ridged on the back, with a broad deeply grooved ridge, 6-6.5 mm long, and 4-4.5 mm wide.

A shrub 4-5 m high, with numerous small ascending stems covered near the ground with ashy gray scaly bark, small spreading gray-brown branches, and stout slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming dark chestnut-brown or purple and lustrous in their first season and dull gray-brown the following year, and armed with few stout slightly curved light chestnut-brown ultimately gray spines 2-2.5 cm long.

Hillsides, Coopers Plains, G. D. Cornell (*63, type), May 23 and September 21, 1906.

***Crataegus bella* Sargent**

Hillsides, Coopers Plains, G. D. Cornell (*31), September 21, 1905, May 20, 1906; also at Buffalo, and at Chippewa, Ontario.

***Crataegus genialis* Sargent**

Rhodora V. 148 (1903).

Hillsides, Coopers Plains, G. D. Cornell (*44), September 24, 1905, May 25, 1906, May and September 1907 (*47), September 28, 1905, May 24 and September 4, 1906.

***Crataegus suavis* Sargent**

Hillsides, Coopers Plains, G. D. Cornell (99), September 22, 1906, June 3, 1907; also at Buffalo.

***Crataegus glaucophylla* Sargent**

Rhodora V. 140 (1903); Rochester Acad. Sci. Proc. IV. 120 (1903).

Hillsides, Coopers Plains, G. D. Cornell (*48), September 28, 1905, May 23, 1906; also southern Michigan and through Ontario to western New England.

***Crataegus matura* Sargent**

Rhodora III. 24 (1901); V. 144 (1903).

Hillsides, Coopers Plains, G. D. Cornell (*21), September 21, 1905, May 21, 1906, (*59) May 24 and September 21, 1906; also Genesee valley, New York to western New England.

***Crataegus streeterae* Sargent**

Rochester Acad. Sci. Proc. IV. 119 (1903).

Hillsides, Coopers Plains, G. D. Cornell (*5), September 21, 1905, May 24, 1906, (*82) September 16, 1906, May 30, 1907; also at Rochester, Buffalo, Niagara Falls, New York, and in southern Michigan.

***Crataegus ornata* Sargent**

Rochester Acad. Sci. Proc. IV. 120 (1903).

Hillsides, Coopers Plains, G. D. Cornell (*95), September 21, 1906, June 2, 1907; also valley of the Genesee river, New York and southern Ontario.

FLABELLATAE***Crataegus steubenensis* n. sp.**

Leaves ovate, long-pointed and acuminate, rounded at the base, finely often doubly serrate, with straight or reflexed glandular teeth, and slightly divided above the middle into 5 or 6 pairs of small spreading acuminate lobes; slightly tinged with red when they unfold, nearly half grown when the flowers open about the 20th of May and then thin, yellow-green and strigose above and paler and glabrous below, and at maturity thin but firm in texture, yellow-green and scabrate above, pale below, 5-6 cm long and 4.5-5 cm wide, with thin prominent midribs often rose color late in the season, and conspicuous primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, villous while young, becoming glabrous, occasionally sparingly glandular, often rose color in the autumn, 2.5-3 cm in length. Flowers 2-2.3 cm in diameter, on long slender sparingly villous pedicels, in lax mostly 7-14-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes long, slender, acuminate, glandular serrate, glabrous on the outer, slightly villous on the inner surface, reflexed after anthesis; stamens 20; anthers pale rose color; styles 3-5, usually 5. Fruit ripening the end of September, on long slender glabrous

red drooping pedicels, in few-fruited clusters, obovate, full and rounded at the apex, abruptly narrowed at the base, scarlet, lustrous, marked by large pale dots, 1-1.2 cm long, and 9-10 mm in diameter; calyx prominent, with a broad deep cavity, and elongated spreading persistent lobes; flesh thick, yellow, sweet and juicy; nutlets usually 5, thin and acute at the ends, flat and slightly grooved on the back, 6-6.5 mm long, and 4-4.5 mm wide.

A narrow shrub 3-4 m high, with small stems covered with pale gray bark, erect branches forming a narrow open head, and stout slightly zigzag branchlets deeply tinged with red when they first appear, becoming light orange-brown, lustrous and marked by numerous pale lenticels in their first season and dull gray-brown the following year, and armed with few stout slightly curved light chestnut-brown shining spines 2-2.5 cm long.

Hillsides, Coopers Plains, G. D. Cornell (*49, type), September 28, 1905, May 21 and September 21, 1906.

COCCINEAE

Crataegus dodgei Ashe

Jour. Elisha Mitchell Sci. Soc. XIX. 26 (March 1903). Sargent, Acad. Sci. Phila. Proc. 632 (1905); *Rhodora* VII. 213 (1905).

Moist hillsides near Coopers Plains, G. D. Cornell (*30), September 21, 1905, May 26, 1906; also southern Michigan to southern New England.

INTRICATAE

Stamens 10; anthers pale yellow

Crataegus intricata Lange

Bot. Tidskr. XIX. 246 (1894). Sargent, *Rhodora* III. 28 (1901).

Moist hillsides, Coopers Plains, G. D. Cornell (*25), September 30, 1905, June 2, 1906, September 1907; also eastern New York and western and southern New England.

Crataegus foetida Ashe

Ann. Carnegie Mus. J, pt III. 380 (1902). Sargent, Acad. Sci. Phila. Proc. 641 (1905); *Rhodora* VII. 219 (1905).

Moist hillsides, Coopers Plains, G. D. Cornell (*34), October 1, 1905, June 2, 1906, (*55) October 8, 1905, June 4, 1906, (*98) September 1907; also Genesee valley, New York to western Massachusetts and eastern Pennsylvania.

***Crataegus verecunda* Sargent**

Rochester Acad. Sci. Proc. IV. 109 (1903).

Moist hillsides, near Coopers Plains, G. D. Cornell (* 51), October 1, 1905, June 2, 1906 (* 56), October 8, 1905, May 30, 1906; grooved ridge, 7-8 mm long, and 4.5-5 mm wide. also at Rochester and near Albany, N. Y.

***Crataegus cornellii* n. sp.**

Glabrous with the exception of the hairs on the upper surface of the young leaves. Leaves oval and acuminate at the ends to ovate-acute and abruptly cuneate at the base, finely doubly serrate, with straight glandular teeth, and divided into 4 or 5 pairs of small acuminate lateral lobes; about half grown when the flowers open late in May or early in June and then very thin, dark yellow-green and slightly hairy above, especially on the midribs and veins, and paler below, and at maturity thin but firm in texture, dark yellow-green, smooth and glabrous on the upper surface, pale yellow-green on the lower surface, 4-4.5 cm long and 3-4 cm wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, often rose color in the autumn, 1-1.2 cm in length; leaves on vigorous shoots ovate, truncate at the broad base, deeply 3-lobed by narrow sinuses, the terminal lobe often lobed toward the apex, and 3.5-5.5 cm long and broad, with stouter glandular petioles. Flowers about 1.5 cm in diameter, on short slender pedicels, in compact mostly 4-10-flowered simple corymbs, with linear-obovate to linear conspicuously glandular bracts and branchlets fading rose color; calyx-tube narrowly obconic, the lobes broad, acuminate, glandular serrate, often widened and laciniately divided toward the apex, reflexed after anthesis; stamens 10; anthers pale yellow; styles 3-5, usually 3. Fruit ripening the end of September, on short stout erect or spreading pedicels, in few-fruited clusters, obovate, rounded at the apex, abruptly narrowed at the base, light orange-yellow, lustrous, marked by small dark dots, 1.3-1.4 cm long and 1-1.2 cm in diameter; calyx very prominent, with a short tube, a wide deep cavity, and elongated spreading and appressed persistent lobes dark red on the upper side below the middle; flesh thin, yellow, dry and hard; nutlets usually 3, rounded and obtuse at the ends, ridged on the back, with a broad low slightly grooved ridge, 7-8 mm long and 4.5-5 mm wide.

A shrub about 1 m high, with small intricately branched erect stems, and slender nearly straight branchlets deeply tinged with red when they first appear, becoming bright chestnut-brown, lustrous, and marked by small pale lenticels in their first season and dull red brown the following year, and armed with very numerous slender nearly straight chestnut-brown shining spines 5.5-6 cm long.

Moist hillsides, Coopers Plains, C. H. Peck (*67, type), June 2 and September 21, 1906.

I am glad to associate with this distinct and pretty species the name of the industrious and careful student of the thorns which cover the hills surrounding his home.

***Crataegus modesta* Sargent**

Rhodora III. 28 (1901); Acad. Sci. Phila. Proc. 635 (1905).

Moist hillsides, Coopers Plains, G. D. Cornell (*39), September 21, 1905, June 2, 1906; also western Vermont and eastern New York to eastern Pennsylvania.

ANOMALAE.

Stamens 10 or less; anthers rose color

***Crataegus singularis* n. sp.**

Leaves ovate to oval, long-pointed and acuminate at the apex, gradually or abruptly narrowed to the concave-cuneate or rounded entire base, coarsely often doubly serrate above with straight glandular teeth, and slightly divided usually only above the middle into 5 or 6 pairs of small acuminate spreading lobes; nearly half grown when the flowers open about the 20th of May and then very thin, convex, dark yellow-green and strigose above and pale yellow-green and slightly villose along the primary veins below, and at maturity thin, glabrous, dark yellow-green and scabrate on the upper surface, light yellow-green and glabrous on the lower surface, 6-7 cm long and 4-4.5 cm wide, with slender yellow midribs and primary veins; turning yellow in the autumn before falling; petioles slender, slightly wing-margined at the apex, sparingly hairy on the upper side while young, soon becoming glabrous, glandular, with minute dark glands, often rose color in the autumn, 2-3 cm in length; leaves on vigorous shoots long-pointed, narrowed and rounded at the base, more coarsely serrate, deeply lobed, with slender acuminate lobes, often 6-7 cm long and 5.5-6 cm wide. Flowers 1.5-1.9 cm in diameter, on long slender slightly villose

pedicels, in compact mostly 6-15-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, red and acuminate at the apex, finely glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 5-8; anthers dark rose color; styles 2-4, usually 3. Fruit ripening from the middle to the end of September, on slender drooping pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, scarlet, lustrous, marked by large pale dots, 1.3-1.5 cm long, 8-10 mm in diameter; calyx little enlarged, with a narrow deep cavity, and elongated spreading and incurved lobes slightly hairy on the upper side; flesh orange-yellow slightly tinged with pink, thick and juicy; nutlets 2 or 3, full and rounded at the ends, or when 3 gradually narrowed at the ends, ridged on the back, with a broad low slightly grooved ridge, marked on the inner faces by broad depressions, 6-7 mm long, and about 4 mm wide.

A shrub 2-3 m high, with stems covered with gray-brown bark, ascending and spreading branches, and stout slightly zigzag glabrous branchlets light orange-green and marked by pale lenticels when they first appear, becoming light olive-green, lustrous and marked by small pale lenticels in their first season and dull gray-brown the following year, and armed with stout slightly curved light red-brown ultimately dark gray spines 3.5-4 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (*20, type), September 21, 1905, May 24, 1906 (*26, with less deeply divided leaves and nearly glabrous pedicels), September 21, 1905, May 14, 1906.

Crataegus repulsans n. sp.

Leaves ovate to rhombic, acuminate and long-pointed at the apex, abruptly or gradually narrowed and concave-cuneate at the entire base, finely often doubly serrate above, with straight or incurved glandular teeth, and slightly divided usually only above the middle into short broad acuminate spreading lobes; nearly fully grown when the flowers open in the last week of May and then thin, yellow-green and strigose above and pale and glabrous below, and at maturity thin but firm in texture, dull yellow-green, glabrous and scabrate on the upper surface, paler on the lower surface, 4-5 cm long and 3-3.5 cm wide, with thin yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, spar-

ingly hairy on the upper side while young, soon becoming glabrous, 1.2-1.6 cm in length; leaves on vigorous shoots abruptly narrowed at the apex into long broad acuminate points, gradually narrowed to the rounded base, thicker, more coarsely serrate, and often 7-8 cm long and 5-5.5 cm wide, with stout rose colored petioles. Flowers 1.5-1.9 cm in diameter, on long slender slightly villose pedicels, in small mostly 5-8-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from the base, red and glandular at the acuminate apex, minutely glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 5-9; anthers rose color; styles 1-3, usually 2. Fruit ripening the end of September, on slender slightly hairy erect pedicels, in few-fruited clusters, short-oblong to subglobose, orange-red, lustrous, marked by small pale dots, 9-10 mm in diameter; calyx prominent, with a deep wide cavity, and elongated spreading and appressed lobes villose on the upper surface; flesh yellow, dry and mealy; nutlets 2 or 3, gradually narrowed and rounded at the ends, or when 3 acuminate at the base and broad and rounded at the apex, ridged on the back, with a broad low grooved ridge, marked on the inner face, by broad depressions, 6-6.5 mm long, and 3.5-4 mm wide.

A shrub 3-4 m in high, with stems covered with greenish gray bark, ascending branches, and stout slightly zigzag glabrous branchlets dark orange-green and marked by pale lenticels when they first appear, becoming bright orange-brown and very lustrous in their first season and pale gray-brown the following year, and armed with very numerous stout straight or slightly curved light chestnut-brown shining spines 4-5 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (*45, type), September 24, 1905, May 28, 1906.

***Crataegus inopinata* n. sp.**

Leaves ovate to oval, acuminate, cuneate or rounded at the entire base, coarsely doubly serrate above, with straight glandular teeth, and occasionally very slightly divided above the middle into small acute lobes; bronze color when they unfold, about half grown when the flowers open in the last week of May and then thin, light yellow-green and roughened above by short white hairs and pale and slightly villose in the axils of the veins below, and at maturity thin but firm in texture, dark yellow-green and scabrate on the upper surface, light yellow-green and glabrous on the lower sur-

pedicels, in compact mostly 6-15-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, red and acuminate at the apex, finely glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 5-8; anthers dark rose color; styles 2-4, usually 3. Fruit ripening from the middle to the end of September, on slender drooping pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, scarlet, lustrous, marked by large pale dots, 1.3-1.5 cm long, 8-10 mm in diameter; calyx little enlarged, with a narrow deep cavity, and elongated spreading and incurved lobes slightly hairy on the upper side; flesh orange-yellow slightly tinged with pink, thick and juicy; nutlets 2 or 3, full and rounded at the ends, or when 3 gradually narrowed at the ends, ridged on the back, with a broad low slightly grooved ridge, marked on the inner faces by broad depressions, 6-7 mm long, and about 4 mm wide.

A shrub 2-3 m high, with stems covered with gray-brown bark, ascending and spreading branches, and stout slightly zigzag glabrous branchlets light orange-green and marked by pale lenticels when they first appear, becoming light olive-green, lustrous and marked by small pale lenticels in their first season and dull gray-brown the following year, and armed with stout slightly curved light red-brown ultimately dark gray spines 3.5-4 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (*20, type), September 21, 1905, May 24, 1906 (*26, with less deeply divided leaves and nearly glabrous pedicels), September 21, 1905, May 14, 1906.

Crataegus repulsans n. sp.

Leaves ovate to rhombic, acuminate and long-pointed at the apex, abruptly or gradually narrowed and concave-cuneate at the entire base, finely often doubly serrate above, with straight or incurved glandular teeth, and slightly divided usually only above the middle into short broad acuminate spreading lobes; nearly fully grown when the flowers open in the last week of May and then thin, yellow-green and strigose above and pale and glabrous below, and at maturity thin but firm in texture, dull yellow-green, glabrous and scabrate on the upper surface, paler on the lower surface, 4-5 cm long and 3-3.5 cm wide, with thin yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, spar-

ingly hairy on the upper side while young, soon becoming glabrous, 1.2-1.6 cm in length; leaves on vigorous shoots abruptly narrowed at the apex into long broad acuminate points, gradually narrowed to the rounded base, thicker, more coarsely serrate, and often 7-8 cm long and 5-5.5 cm wide, with stout rose colored petioles. Flowers 1.5-1.9 cm in diameter, on long slender slightly villose pedicels, in small mostly 5-8-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from the base, red and glandular at the acuminate apex, minutely glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 5-9; anthers rose color; styles 1-3, usually 2. Fruit ripening the end of September, on slender slightly hairy erect pedicels, in few-fruited clusters, short-oblong to subglobose, orange-red, lustrous, marked by small pale dots, 9-10 mm in diameter; calyx prominent, with a deep wide cavity, and elongated spreading and appressed lobes villose on the upper surface; flesh yellow, dry and mealy; nutlets 2 or 3, gradually narrowed and rounded at the ends, or when 3 acuminate at the base and broad and rounded at the apex, ridged on the back, with a broad low grooved ridge, marked on the inner face, by broad depressions, 6-6.5 mm long, and 3.5-4 mm wide.

A shrub 3-4 m high, with stems covered with greenish gray bark, ascending branches, and stout slightly zigzag glabrous branchlets dark orange-green and marked by pale lenticels when they first appear, becoming bright orange-brown and very lustrous in their first season and pale gray-brown the following year, and armed with very numerous stout straight or slightly curved light chestnut-brown shining spines 4-5 cm long.

Rich hillsides, Coopers Plains, G. D. Cornell (*45, type), September 24, 1905, May 28, 1906.

***Crataegus inopinata* n. sp.**

Leaves ovate to oval, acuminate, cuneate or rounded at the entire base, coarsely doubly serrate above, with straight glandular teeth, and occasionally very slightly divided above the middle into small acute lobes; bronze color when they unfold, about half grown when the flowers open in the last week of May and then thin, light yellow-green and roughened above by short white hairs and pale and slightly villose in the axils of the veins below, and at maturity thin but firm in texture, dark yellow-green and scabrate on the upper surface, light yellow-green and glabrous on the lower sur-

face, 4.5-6 cm long and 4-5 cm wide, with thin prominent yellow midribs and primary veins; petioles stout, slightly wing-margined at the apex, glabrous, sparingly glandular early in the season, usually with deciduous glands, generally rose color in the autumn, 2-3 cm in length; leaves on vigorous shoots rounded at the base, coarsely serrate, rarely slightly lobed, and often 8-10 cm long and 6-7.5 cm wide, with stout broadly winged conspicuously glandular petioles. Flowers 1-1.2 cm in diameter, on slender slightly villose pedicels, in narrow compact mostly 10-16-flowered corymbs; calyx-tube narrowly obconic, glabrous, the lobes wide, acuminate and red at the apex, glandular serrate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 5-7; anthers pale rose color; styles 2 or 3, surrounded at the base by a narrow ring of long white hairs. Fruit ripening the end of September, on stout slightly spreading pedicels, in few-fruited clusters, subglobose, dark red, lustrous, marked by small pale dots, 1-1.1 cm in diameter; calyx little enlarged, with a broad shallow cavity, small spreading and closely appressed persistent lobes villose and dark red on the upper side; flesh thick, juicy, orange color; nutlets 2 or 3, rounded at the ends, ridged on the back, with a broad high doubly grooved ridge slightly penetrated on the inner faces by wide depressions, 5-5.5 mm long, and 3.5-4 mm wide.

A shrub occasionally 6-8 but more often 3-4 m high, with stout stems covered with dark bark scaly near the ground, ascending branches forming an open irregular head, and stout slightly zigzag glabrous branchlets dark orange-yellow and marked by pale lenticles when they first appear, becoming dark chestnut-brown and lustrous in their first season and dull reddish brown the following year, and armed with numerous stout straight or slightly curved chestnut-brown shining spines 3.5-6 cm long.

Rich hillsides, near Coopers Plains, G. D. Cornell (* 60, type), May 26 and September 21, 1906, June and September, 1907.

TOMENTOSAE

Leaves thin

Anthers rose color; stamens 12-20

***Crataegus diversa* n. sp.**

Leaves oblong-obovate, acute, acuminate or rarely rounded at the apex, gradually narrowed to the long concave-cuneate entire base, coarsely often doubly serrate above, with straight glandular



teeth, and sometimes slightly divided above the middle into 2 or 3 pairs of small acute lobes; nearly half grown when the flowers open the middle of June and then thin, light yellow-green and slightly roughened above by short white hairs and pale and villose on the midribs and veins below, and at maturity thin but firm in texture, dark yellow-green, glabrous and smooth on the upper surface, still villose on the lower surface along the stout midribs and prominent primary veins, 6-8 cm long and 4.5-5 cm wide; petioles stout, wing-margined to below the middle, tomentose early in the season, becoming pubescent or nearly glabrous, 8-12 mm in length. Flowers 1.3-1.6 cm in diameter, on short stout villose pedicels, in compact mostly 15-18-flowered hairy corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, coated with long matted white hairs, the lobes long, slender, acuminate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 12-20; anthers rose color; styles 2, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening late in September, on slightly hairy red drooping pedicels, in few-fruited clusters, oval or slightly obovate, crimson, lustrous, marked by small pale dots, 9-10 mm long, and 6-7 in diameter; calyx little enlarged, with a short tube, a deep wide cavity, and small spreading and appressed often deciduous lobes dark red and villose on the upper side; flesh thin, yellow, dry and mealy; nutlets 2, rounded at the ends, rounded and slightly ridged on the back, penetrated on the inner faces by large deep cavities, 5-5.5 mm long, and 3-3.5 mm wide.

A shrub 3-4 m high, with numerous small erect stems covered with ashy gray bark, small ascending slightly spreading branches forming an open head, slender nearly straight branchlets covered when they first appear with long matted white hairs, becoming light orange-brown or chestnut-brown, lustrous, puberulous and marked by pale lenticels at the end of their first season, and dull reddish brown in their second or third years, and armed with straight slender chestnut-brown and shining ultimately dull gray spines 3-4 cm long, occasionally persistent and compound on old stems.

Hillsides, near Coopers Plains, G. D. Cornell (*70, type), June 18 and September 21, 1906 (*78), June and October 1906, 1907.

Well distinguished from *Crataegus tomentosa* Linneus, by the color of the branches and spines, the smaller number of stamens, and by the shape and color of the fruit.

Anthers pink; stamens 20

***Crataegus spinifera* n. sp.**

Leaves ovate to obovate, acute or acuminate, gradually narrowed and concave-cuneate at the entire base, and sharply often doubly serrate above, with straight glandular teeth; about one third grown when the flowers open the 1st of June and then very thin, dark yellow-green and covered above by soft white hairs and pale and villose below along the midribs and veins, and at maturity thin but firm in texture, yellow-green, smooth and lustrous on the upper surface, pale bluish green and still slightly villose on the lower surface on the stout yellow midribs and slender primary veins, 5.5-7 cm long and 3.5-5 cm wide; petioles stout, narrow wing-margined to below the middle, slightly hairy on the upper side while young, soon becoming glabrous, 1-2 cm in length; leaves on vigorous shoots abruptly cuneate or rounded at the base, often slightly lobed toward the apex, and frequently 7-8 cm long and 5-6 cm wide. Flowers about 1.5 cm in diameter, on slender villose pedicels, in broad lax hairy mostly 20-30-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, coated with long matted white hairs, the lobes long, slender, glandular serrate, villose, reflexed after anthesis; stamens 20; anthers pale pink; styles 2-4. Fruit ripening the end of September, on long stout slightly hairy red drooping pedicels, in broad many-fruited clusters, subglobose to slightly ovate, scarlet, lustrous, sparingly hairy at the ends, marked by large pale dots, becoming soft and succulent, 1-1.2 cm in diameter; calyx little enlarged, with a deep narrow cavity, and small spreading and appressed lobes hairy on the upper side; flesh yellow, thin and dry; nutlets 2-4, slightly narrowed and rounded at the ends, ridged on the back, with a broad low grooved ridge, irregularly penetrated on the inner faces by broad deep cavities, 6-7 mm long, and 4-5 mm wide.

A dense round-topped shrub 3-4 m high, with small intricately branched stems spreading in thickets and covered with dark gray-brown scaly bark, ascending flexuous greenish gray branches, and slender slightly zigzag glabrous branchlets dark orange-green and marked by pale lenticels when they first appear, becoming orange-brown and lustrous in their first season and dull gray-brown the following year, and armed with numerous stout nearly straight purple shining spines 4-5 cm long.

Hillside, Coopers Plains, G. D. Cornell (*66, type), June 4 and September 21, 1906.

Anthers pale yellow; stamens 20

***Crataegus structilis* Ashe**

Jour. Elisha Mitchell Sci. Soc. XIX. 12 (1903). Sargent, Acad. Sci. Phila. Proc. 656 (1905).

Hillsides, near Coopers Plains, G. D. Cornell (*50), September 30, 1905, June 18, 1906, (*52), June 13 and September 21, 1906, (*69), June 18 and September 21, 1906, (*71), with stamens sometimes reduced to 15), June and September 1906; also Illinois and southern Michigan, and through southern Ontario to the valley of the Genesee river, New York and eastern Pennsylvania.

***Crataegus comans* n. sp.**

Leaves ovate to rhombic, acute at the apex, concave-cuneate at the entire base, and coarsely doubly serrate above, with straight glandular teeth; tinged with red when they unfold, about half grown when the flowers open from the 10th to the middle of June and then thin, yellow-green and roughened above by short white hairs most abundant on the midribs and veins, paler and villose below especially on the midribs and veins, and at maturity thin but firm in texture, dull yellow-green, smooth and lustrous on the upper surface, pale yellow-green and still villose below, 4.5-6 cm long and 3.5-5 cm wide, with stout midribs, often rose color in the autumn, and thin prominent primary veins; petioles stout, wing-margined nearly to the base, villose, 4-5 mm in length. Flowers 1.2-1.5 cm in diameter, on short stout densely villose pedicels, in very compact hairy mostly 10-15-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, slightly hairy, the lobes short, slender, minutely glandular serrate, nearly glabrous on the outer, slightly hairy on the inner surface, reflexed after anthesis; petals sometimes tinged with pink; stamens 20; anthers pale yellow; styles 2 or 3. Fruit ripening late in September, on long slender hairy erect pedicels, in wide many-fruited clusters, short-oblong to subglobose, orange-red, lustrous, covered with short pale hairs most abundant at the base, 7-8 mm in diameter; calyx little enlarged, with a short tube, a wide deep cavity and small spreading and appressed persistent lobes villose on the upper surface; flesh thin, yellow, becoming soft and

succulent; nutlets usually 2, suborbicular, rounded and slightly grooved on the back, penetrated on the inner faces by broad deep cavities, about 5 mm long, and 2-2.5 mm wide.

A shrub 2-3 m high, with stems covered with pale gray bark, ascending branches, and slender nearly straight branchlets dark orange-red and covered with long matted pale hairs when they first appear, becoming light orange-red and lustrous and still hairy in their first season and dark gray-brown the following year, and armed with slender straight or slightly curved gray spines 2.5-3 cm long.

Hillsides, Coopers Plains, G. D. Cornell (*35, type), June 13 and September 21, 1906.

Leaves thick

Stamens 20; anthers purple

Crataegus frutescens n. sp.

Leaves obovate, gradually narrowed and acute or rounded at the apex, concave-cuneate at the entire base, finely often doubly serrate above, with straight glandular teeth, and slightly divided generally only above the middle into 3 or 4 pairs of small acuminate lobes; faintly tinged with bronze color and slightly hairy above, especially along the midribs, when they unfold, more than half grown when the flowers open late in May or early in June, and then thick, light yellow-green and nearly glabrous above and pale and villose on the midribs and veins below, and at maturity subcoriaceous, conspicuously reticulate venulose, dark yellow-green, smooth and very lustrous on the upper surface, light yellow-green and still slightly hairy on the lower surface along the stout rose colored midribs and slender primary veins, 4-5 cm long and 3.5-4 cm wide; petioles stout, slightly wing-margined to below the middle, sparingly villose while young, soon becoming glabrous, often deep rose color in the autumn, 7-10 mm in length; leaves on vigorous shoots ovate to oval, more coarsely serrate and 6-6.5 cm long and 5-6 cm wide, with stout broadly winged often glandular petioles. Flowers 1.4-1.6 cm in diameter, on slender villose pedicels, in compact mostly 10-15-flowered corymbs, with long narrow obovate to linear acuminate glandular caducous bracts and bractlets, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, slightly hairy at the base, glabrous above, the lobes gradually narrowed, short, broad, acuminate, finely glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after

anthesis; stamens 20; anthers purple; styles 2 or 3. Fruit ripening the end of September, on slender slightly hairy erect pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, scarlet, very lustrous, marked by large pale dots, 7-8 mm in diameter; calyx little enlarged, with a broad deep cavity, and small spreading and appressed lobes; flesh yellow, dry; nutlets 2 or 3, gradually narrowed and rounded at the ends, rounded and slightly ridged on the back, penetrated on the inner faces by deep narrow cavities, 4.5-5 mm long, and about 3 mm wide.

A shrub sometimes 2 m high, with stems covered with dark greenish gray bark and spreading into thickets, small ascending branches, slender nearly straight glabrous branchlets light orange-green and marked by pale lenticels when they first appear, light chestnut-brown and very lustrous in their first and second seasons and dull reddish brown the following year, and armed with numerous stout slightly curved chestnut-brown shining spines 3-4 cm long, compound and long persistent on old stems, and accrescent bright rose colored very conspicuous inner bud scales deciduous before the opening of the flower buds.

Coopers Plains, G. D. Cornell (*37, type), September 21, 1905, June 3, 1906.

Stamens 10 or less; anthers pale yellow

***Crataegus ferentaria* Sargent**

Rochester Acad. Sci. Proc. IV. 135 (1903); *Rhodora* VII. 184 (1905).

Hillsides, Coopers Plains, G. D. Cornell (*22), September 21, 1905, June 2, 1906; also southern Ontario to eastern New England.

NEW YORK SPECIES OF CRATAEGUS FROM VARIOUS LOCALITIES

BY C. S. SARGENT

PRUINOSAE

Crataegus bronxensis n. sp.

Leaves ovate, acuminate, gradually or abruptly narrowed and concave-cuneate at the entire base, sharply often doubly serrate above, with straight glandular teeth, and divided above the middle into 3 or 4 pairs of short acuminate lobes; nearly half grown when the flowers open late in May and then thin, light yellow-green and slightly hairy especially on the midribs above, and paler and sparingly villose along the midribs and veins below, with persistent hairs, and at maturity very thin, dark bluish green and scabrate on the upper surface, pale blue-green on the lower surface, 4.5-5.5 cm long and 3-4 cm wide, with slender midribs, and thin primary veins extending very obliquely to the points of the lobes; petioles slender, wing-margined at the apex, glabrous, glandular, with occasional mostly persistent glands, often rose colored in the autumn, 2.5-3 cm in length; leaves on vigorous shoots sometimes rounded at the broad base, more coarsely serrate and more deeply lobed, and often 6-7 cm long and 5-6 cm wide. Flowers 1.8-2 cm in diameter, on short slender slightly hairy pedicels, in compact mostly 5-7-flowered corymbs, with linear acuminate bracts and bractlets fading brown and often persistent until the flowers open, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, glabrous, the lobes abruptly narrowed from wide bases, slender, acuminate, entire or occasionally minutely glandular dentate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 20; anthers light pink; styles 4 or 5. Fruit on erect slender pedicels, in few-fruited clusters, falling late in the autumn without becoming soft, subglobose or rather broader than high, apple-green, slightly pruinose, becoming lustrous, marked by large dark dots, 1-1.2 cm in diameter; calyx prominent, with a short tube, a broad shallow cavity, and spreading and reflexed often deciduous lobes dark red on the upper side below the middle; flesh thin, green, dry and hard; nutlets 4 or 5, gradually narrowed and rounded at the ends, rounded and grooved or irregularly ridged on the back, 6-6.5 mm long and about 4 mm wide.

A shrub, with slender slightly zigzag glabrous branchlets orange-green more or less tinged with red when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels in their first season and dull red-brown the following year, and armed with numerous slender straight or slightly curved chestnut-brown shining spines 3.5-5.5 cm long.

In Bronx park, New York city, W. W. Eggleston (* 154, type), October 5, 1904, May 25, 1907.

***Crataegus livingstoniana* n. sp.**

Glabrous with the exception of the hairs on the upper side of the leaves. Leaves ovate, acuminate, abruptly cuneate or rounded at the entire base, coarsely often doubly serrate above, with straight glandular teeth, and slightly divided into 4 or 5 pairs of small acuminate spreading lobes; about half grown when the flowers open in the last week of May and then very thin, yellow-green and slightly hairy above and pale below, and at maturity thin, light yellow-green, smooth or occasionally hairy and roughened on the upper surface, paler on the lower surface, 5-7 cm long and 4-5.5 cm wide, with thin midribs, and primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, occasionally glandular, 1.5-3 cm in length; leaves on vigorous shoots thicker, rounded or cordate at the base, more deeply lobed and more coarsely serrate. Flowers 1.6-1.8 cm in diameter, on long slender pedicels, in mostly 5-8-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, long, slender, glandular and acuminate at the apex, minutely glandular dentate, reflexed after anthesis; stamens usually 8; anthers dark red; styles 3-5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the middle of October, on stout spreading or drooping pedicels, in few-fruited clusters, short-oblong, full and rounded at the ends, red, lustrous, marked by many small pale dots, 1.2-1.5 cm long and 1-1.2 cm in diameter; calyx prominent, with a deep narrow cavity pointed and tomentose in the bottom, and elongated spreading and incurved persistent lobes dark red on the upper side; nutlets 3-5, narrowed and acute at the ends or when 3 rounded at the ends, rounded and grooved or slightly ridged on the back, 6.5-7 mm long, and about 4 mm wide.

An arborescent shrub sometimes 5-6 m high, with stems 1-1.5 dm in diameter covered with ashy gray bark, ascending branches form-

ing a narrow fastigate head, and slender nearly straight branchlets dark orange-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season, dull gray the following year, and armed with occasional stout nearly straight light chestnut-brown shining spines 2.5-3 cm long.

Roadside, near east bank of Hemlock lake, Livingston co., Henry T. Brown (*23, type), May 28 and October 1906, (*13) May 28 and October 13, 1906, (*18, with 6-8 stamens) May 18 and October 1906, (*16, with rather lighter colored anthers) May and October 1906.

***Crataegus macera* n. sp.**

Leaves ovate, rounded, truncate or cuneate at the entire base, finely often doubly serrate above, with glandular teeth, and slightly divided into 5 or 6 pairs of small acuminate lateral lobes; more than half grown when the flowers open the end of May and then thin, dark yellow-green, slightly hairy above and pale and glabrous below, and at maturity very thin, dull yellow-green and scabrate on the upper surface, paler on the lower surface, 4-5 cm long, and 3.5-4 cm wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, glandular while young, 1.5-2.5 cm in length; leaves on vigorous shoots thin, truncate or rounded at the broad base, more coarsely serrate, more deeply lobed, and often 6.5-7 cm long and 6.6-5 cm wide, with slender rose colored glandular petioles. Flowers about 2 cm in diameter, on long slender glabrous pedicels, in wide mostly 6-10-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, glabrous, the lobes separated by wide sinuses, gradually narrowed from the base, long, slender, acuminate and glandular at the apex, entire or occasionally glandular dentate above the middle, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 5-7, usually 7; anthers light rose color; styles 4 or 5, surrounded at the base by a ring of pale tomentum. Fruit ripening the middle of October, on slender drooping pedicels, in few-fruited clusters, subglobose to short-oblong, scarlet, lustrous, marked by small dark dots, about 1 cm in diameter; calyx little enlarged, with a broad deep cavity tomentose on the inner surface, and spreading lobes dark red on the upper side below the middle; flesh yellow-green, dry and mealy; nutlets 4 or 5, gradually narrowed and rounded at the ends or

acute at the base, ridged on the back, with a broad high grooved ridge, 6-6.5 mm long, and 4.5-5 mm wide.

An arborescent shrub 5-6 m high, with numerous light ashy gray stems sometimes 1.3-1.5 dm in diameter, spreading and drooping branches, and slender slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season and dull gray-brown the following year, and armed with numerous slender often recurved chestnut-brown shining spines 3.5-4.5 cm long.

Moist soil in dense thickets, near the east bank of Hemlock lake, Livingston co., Henry T. Brown (*22, type), May 28 and October 16, 1906.

TENUIFOLIAE

Crataegus leptopoda n. sp.

Glabrous with the exception of the hairs on the upper surface of the young leaves and petioles. Leaves oblong-ovate, gradually narrowed at the base, finely often doubly serrate, with straight glandular teeth, and slightly divided into 6 or 7 pairs of narrow acuminate spreading lobes; about half grown when the flowers open in the last week of May and then very thin, yellow-green and slightly roughened above by short white hairs and pale below, and at maturity thin, smooth and dull dark yellow-green on the upper surface, paler on the lower surface, 6-7 cm long and 3.5-4 cm wide, with slender midribs and primary veins; petioles very slender, slightly wing-margined at the apex, sparingly hairy on the upper side while young, soon becoming glabrous, glandular, with minute often persistent glands, 2-3 cm in length. Flowers about 1.5 cm in diameter, on long slender pedicels, in mostly 10-12-flowered narrow corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, long, slender, red and glandular at the acuminate apex, entire or minutely glandular dentate near the middle, reflexed after anthesis; stamens 5-10; anthers dark red or maroon; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening late in September, on long slender drooping pedicels, in few-fruited clusters, obovate, rounded at the apex, gradually narrowed at the base, bright cherry-red, lustrous, marked by small pale dots, 1-1.2 cm long, and 8-9 mm in diameter; calyx little enlarged, with a shallow narrow cavity and erect or incurved persistent lobes dark red on the upper side below the middle; flesh thin, yellow-green and juicy; nutlets 3 or 4, acuminate

at the base, narrow and rounded at the apex, slightly ridged on the back, with a rounded ridge 6-6.5 mm long, and about 4 mm wide.

A shrub sometimes 5 m high, with stout slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming dark chestnut-brown and lustrous in their first season and dull gray-brown the following year, and armed with numerous stout curved or nearly straight chestnut colored shining spines 3.5-4 cm long, persistent and simple on the stem.

East bank of Hemlock lake, Livingston co., H. T. Brown (*26 type), May 28 and October 3, 1906, (*25, with lighter colored anthers) May and September 1906.

***Crataegus gracilipes* n. sp.**

Glabrous with the exception of the hairs on the upper surface of the leaves. Leaves ovate, long-pointed and acuminate at the apex, gradually or abruptly narrowed and concave-cuneate at the entire base, sharply often doubly serrate, with long straight glandular teeth, and divided often only above the middle into 5 or 6 pairs of long slender acuminate spreading lobes; nearly fully grown when the flowers open in the last week of May and then very thin, light yellow-green, lustrous and slightly hairy above and pale and glaucous below, and at maturity thin, scabrate and dull yellow-green above, paler below, 7-8 cm long and 4.5-6 cm wide, with slender midribs and primary veins; petioles slender, slightly wing-margined at the apex, glandular while young, with minute deciduous glands, 3-5 cm in length. Flowers about 1.5 cm in diameter, on long slender pedicels, in mostly 5-12-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, slender, very long, acuminate and red at the apex, finely glandular serrate usually only near the middle, reflexed after anthesis; stamens 6-8; anthers light red; styles 3 to 5. Fruit ripening the end of September, on long slender drooping pedicels, in few-fruited clusters, narrow-obovate, gradually narrowed and rounded at the apex, gradually narrowed to the long slender base, scarlet, lustrous, 1.2-1.3 cm long, 6-7 mm wide; calyx little enlarged, with a deep wide cavity, and spreading persistent lobes; flesh yellow-green, thick and juicy; nutlets 3-5, narrowed and acute at the ends, or when 3 broader and rounded at the apex, ridged on the back, with a broad low slightly grooved ridge, 6.5-7 mm long, and 5-5.5 mm wide.

A shrub sometimes 6 m high, with small stems covered with pale gray bark, ascending and drooping tortuous branches, and slender branchlets deeply tinged with red and marked by pale lenticels when they first appear, becoming dark chestnut-brown and lustrous in their first season and dark dull gray-brown the following year, and armed with stout slightly curved or straight dull chestnut-brown spines 2.5-3 cm long.

Thickets in moist soil, near the eastern bank of Hemlock lake, Livingston co., New York, Henry T. Brown (*21, type), May 28 and October 4, 1906.

***Crataegus claytoniana* n. sp.**

Glabrous with the exception of the hairs on the young leaves. Leaves oblong-ovate, acuminate, rounded or abruptly cuneate at the base, finely often doubly serrate above, with straight or incurved glandular teeth, and divided into 4 or 5 pairs of slender spreading acuminate lateral lobes; bronze-red and covered above by short white hairs when they unfold, more than half grown when the flowers open about the 10th of June and then thin, light yellow-green and still hairy above and pale and glabrous below, and at maturity thin, dark yellow-green and slightly roughened on the upper surface, light yellow-green on the lower surface, 3-4.5 cm long and 2.5-3 cm wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, glandular, with occasional persistent glands, 1.5-2.5 cm in length; leaves on vigorous shoots thicker, long-pointed, rounded or truncate at the broad base, more coarsely serrate and more deeply lobed, and often 5-6 cm long and 4-5 cm wide, with stout rose colored midribs, and conspicuously glandular petioles. Flowers 1-1.2 cm in diameter, on slender pedicels, in small lax 5-10-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes slender, acuminate and red at the apex, entire or occasionally minutely glandular dentate, reflexed after anthesis; stamens 5-8; anthers red; styles 2 or 3. Fruit ripening the end of September, on short drooping pedicels, in 1-3-fruited clusters, subglobose to short-oblong, scarlet, lustrous, 1-1.2 cm long, about 1 cm in diameter; calyx little enlarged, with a wide shallow cavity, and spreading mostly persistent lobes bright red on the upper side below the middle; flesh thick, rather juicy, yellow slightly tinged with red; nutlets 2 or 3, narrowed and rounded at the ends, ridged

on the back, with a low broad slightly grooved ridge, 6.5-7 mm long, and 4-4.5 mm wide.

A shrub 3-4 m high, with stout stems, long slender erect or diverging branches, and slender nearly straight branchlets dark orange-green more or less tinged with red when they first appear, becoming light chestnut-brown, lustrous and marked by small pale lenticels in their first season and dark grayish brown the following year, and armed with slender straight or slightly curved bright chestnut-brown shining spines 2.5-3 cm long.

Clayton, Jefferson co., C. H. Peck (*3, type), June 14 and September 27, 1907.

COCCINEAE

Crataegus chateaugayensis n. sp.

Leaves ovate, acuminate or acute at the apex, concave-cuneate or rarely rounded at the entire base, finely often doubly serrate above with straight glandular teeth, and divided into 4-6 pairs of small acuminate spreading lateral lobes; deeply tinged with red when they unfold, about half grown when the flowers open in the first week of June, and then thin, yellow-green and roughened above by short white hairs and glabrous below, and at maturity dark yellow-green, smooth and slightly villose along the midribs on the upper surface, and paler and lustrous on the lower surface, 5.5-6.5 cm long, and 3.5-4 cm wide, with slender midribs rose colored in the autumn, and thin primary veins arching obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, sparingly villose on the upper side while young, becoming glabrous, glandular, with numerous dark usually persistent glands, 2-3 cm in length. Flowers 1.6-1.8 cm in diameter, on long slender glabrous or occasionally slightly hairy pedicels, in compact mostly 10-12-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate and red at the apex, coarsely and conspicuously glandular dentate, reflexed after anthesis; stamens 5; filaments persistent on the ripe fruit; anthers dark rose color; styles 4 or 5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the middle of September, on stout drooping red glabrous or occasionally slightly hairy pedicels, in few-fruited clusters, short-oblong to oval, scarlet, marked by large pale dots, slightly pruinose, 1.2-1.4 cm long, 8-10 mm in diameter; calyx prominent, with a short tube, a wide cavity tomentose in the bottom, and spreading and reflexed persistent lobes; flesh thick, firm light

yellow; nutlets 4 or 5, gradually narrowed and rounded at the base, thicker and rounded at the apex, ridged on the back, with a broad low deeply grooved ridge, 7-9 mm long, and 3.5-4 mm wide.

An arborescent shrub or tree 7-8 m high, with stout slightly zigzag glabrous branchlets, dark green and marked by pale lenticels when they first appear, becoming orange-brown or chestnut-brown in their first season and dull gray-brown the following year, and armed with very numerous stout straight or slightly curved light chestnut-brown shining spines 4-7 cm long.

Near Chateaugay lake, Franklin co., J. G. Jack (*1, type), September 15, 1903, June 8, 1905.

***Crataegus spissa* n. sp.**

Leaves ovate, acuminate, gradually narrowed and concave-cuneate at the entire base, sharply doubly serrate above, with straight glandular teeth, and divided usually only above the middle into 4 or 5 pairs of small acuminate lobes; tinged with red and covered with long white hairs when they unfold, nearly half grown when the flowers open at the end of May and then thin, yellow-green and roughened above by short hairs and paler and glabrous below, and at maturity thin, dark yellow-green, smooth, glabrous and lustrous on the upper surface, pale yellow-green on the lower surface, 4-5 cm long and 3-4 cm wide, with slender yellow midribs, and thin primary veins arching obliquely to the points of the lobes; petioles slender, wing-margined at the apex, sparingly villose on the upper side while young, soon becoming glabrous, glandular with often persistent glands, 1.2-2 cm in length; leaves on vigorous shoots thicker, often rounded or truncate at the broad base, more coarsely serrate and more deeply lobed, 7-9 cm long and 7-8 cm wide, with broadly winged glandular petioles. Flowers 1.2-1.3 cm in diameter, on short glabrous or slightly hairy pedicels, in small very compact 5-10-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from broad bases, acuminate, glandular dentate usually only above the middle, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 10; anthers pink or purplish red; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the middle of September, on short drooping pedicels, in few-fruited clusters, subglobose to oval, scarlet, lustrous, marked by small pale dots; calyx little enlarged, with a wide shallow cavity, and small spreading serrate lobes, their tips

often deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 3 or 4, gradually narrowed and rounded at the ends, ridged on the back, with a long narrow ridge, 6-7 mm long, and 3.5-4 mm wide.

A shrub 3-4 m high, with numerous small stems, ascending or suberect branches, and slender slightly zigzag glabrous branchlets dark orange-green when they first appear, becoming bright chestnut-brown, lustrous and marked by pale lenticels in their first season and dull gray-brown the following year, and armed with numerous slender straight or slightly curved chestnut-brown shining spines 3.5-6 cm long.

Dry sandy or rocky soil, North Elba, Essex co., common and the prevailing species, C. H. Peck (*41, type), May 27, June 2 and September 18, 1903, (*41') July 22 and September 18, 1904.

***Crataegus verrucalis* n. sp., Peck**

Leaves ovate to slightly obovate, acuminate and long-pointed at the apex, gradually narrowed and cuneate at the base, finely often doubly serrate, with straight glandular teeth, and divided usually only about the middle into 4 or 5 pairs of slender acuminate spreading lobes; bronze-red and covered on the upper surface with short white hairs when they unfold, more than half grown when the flowers open at the end of May or early in June and then thin, yellow-green and still slightly hairy above and paler below, and at maturity thin, yellow-green on the lower surface, 4-4.5 cm long and 2.5-3 cm wide, with thin prominent midribs, and rather obscure primary veins; petioles slender, slightly wing-margined at the apex, glabrous, glandular, with often persistent glands, 1.5-2 cm in length; leaves on vigorous shoots broadly ovate to suborbicular, rounded at the base, more coarsely serrate and more deeply lobed. Flowers 1.2-1.4 cm in diameter, on short slender slightly villose pedicels, in small compact 4-10-flowered hairy corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, villose, the lobes slender, acuminate, glandular dentate, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 5-10; anthers red; styles 2-4, usually 3. Fruit ripening from the middle to the end of September and often persistent until after the leaves have fallen, on slender slightly hairy drooping, pedicels, in few-fruited clusters, subglobose to short-oblong, scarlet, lustrous, 1-1.2 cm long and 8-10 mm in diameter; calyx little enlarged, with a deep narrow cavity, and small

spreading often deciduous lobes; flesh thin, yellow; nutlets usually 3, acute at the base, thicker and rounded at the apex, ridged on the back, with a low doubly grooved ridge, 6.5-7 mm long, and 3.5-4 mm wide.

A shrub or small tree 2-4 m high, with a stem sometimes 5 dm in diameter and like the long slender mostly erect branches covered with dark brown verrucose bark, and slender glabrous branchlets yellow-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and lustrous in their first season and dark red-brown the following year, and armed with numerous stout straight light chestnut-brown shining spines 3.5-4 cm long.

Adirondack region, common; C. H. Peck (* ffc, type), June 18 and October 1, 1907.

Related to *Crataegus praecoqua* Sargent, *Crataegus verrucalis* may be distinguished from that species by its smaller leaves and flower clusters, fewer stamens and styles, by its smaller and late hanging fruit, and by the peculiar wartlike excrescences on the bark.

***Crataegus harryi* n. sp.**

Glabrous with the exception of the hairs on the upper surface of the young leaves and on the calyx-lobes. Leaves obovate, gradually narrowed and acute or acuminate at the apex, concave-cuneate at the entire base, or occasionally oval and acuminate at the ends, sharply doubly serrate, with straight glandular teeth, and divided above the middle into numerous short slender acuminate lobes; nearly fully grown when the flowers open the last of May and then very thin, dark yellow-green and covered above by soft white hairs and paler below, and at maturity thin, dull light yellow-green and scabrate on the upper surface and yellow-green and lustrous on the lower surface, 6-7 cm long and 4-4.5 cm wide, with slender yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, 1.5-3 cm in length; leaves on vigorous shoots thicker, deeply lobed, more coarsely serrate, and often 12-14 cm long and 8-9 cm wide. Flowers 1.3-1.5 cm in diameter, on slender pedicels, in wide mostly 7-15-flowered corymbs, the long lower peduncles from the axils of upper leaves; calyx-tube very narrow, obconic, the lobes long, slender, acuminate, minutely glandular dentate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 5 or 6; anthers pink; styles 2-4. Fruit ripening and falling early in October, on slender reddish pedicels, in few-fruited spreading clusters, short-oblong to slightly obovate,

rounded at the ends, cherry-red, lustrous, marked by small pale dots, about 1 cm long and 8-9 mm in diameter; calyx prominent, with a wide deep cavity tomentose in the bottom, and long spreading and incurved persistent lobes; flesh thin, yellow-green, dry and mealy; nutlets 2-4, rounded at the base, gradually narrowed and acute at the apex, or when 4 acute at the ends, ridged on the back, with a high broad irregularly grooved ridge 7-7.5 mm long, and about 5 mm wide.

A slender tree sometimes 8 m high, with a short trunk occasionally 2 dm in diameter and covered with pale gray very scaly bark, small spreading dark gray branches spotted with lighter gray, and very slender nearly straight branchlets dark orange-brown and marked by pale lenticels when they first appear, becoming light yellow-brown and lustrous in their first season and dull light gray-brown the following year, and armed with occasional slender nearly straight or slightly curved light chestnut-brown spines 2.5-3 cm long.

Borders of woods in low bottom lands of Wet-stone brook near the Honeoye state road, Richmond, Ontario co., Henry T. Brown (*38, type), May 28 and October 17, 1906.

Both Brown and Henry having been used in forming specific names in *Crataegus*, *Crataegus harryi*, one of the most distinct and interesting of his discoveries will serve to commemorate the name of Henry T. Brown of Rochester, New York, who has carefully studied and collected the numerous thorns found by him near Hemlock and Honeoye lakes in Livingston and Ontario counties.

ANOMALAE

Crataegus simulans n. sp.

Leaves ovate to slightly obovate or oval, acuminate or rounded at the apex, gradually narrowed to the concave-cuneate entire base, sharply often doubly serrate above, with straight glandular teeth, and slightly divided usually only above the middle into 4 or 5 pairs of small acuminate spreading lobes; nearly fully grown when the flowers open in the last week of May and then thin, yellow-green and slightly roughened above by short white hairs and paler and glabrous below, and at maturity thin, dull yellow-green and scabrate on the upper surface, paler on the lower surface, 5-6 cm long and 2.5-5 cm wide, with thin light yellow midribs and primary veins; petioles slender, slightly wing-margined at the apex, sparingly villose on the upper side while young, soon becoming glabrous, often rose colored in the autumn at the base, 1.5-2.5 cm in length; leaves

on vigorous shoots somewhat larger, more deeply lobed and more coarsely serrate. Flowers 1.8-2 cm in diameter, on long slender slightly villose pedicels, in wide lax mostly 9-14-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes abruptly narrowed at the base, long, slender, acuminate, minutely glandular dentate, glabrous on the outer, slightly hairy on the inner surface, reflexed after anthesis; stamens 10; anthers light pink; styles 3 or 4, surrounded at the base by a few pale hairs. Fruit ripening early in October, on long slender reddish pedicels furnished with occasional hairs, in few-fruited clusters, short-oblong to slightly obovate, bright red, lustrous, marked by small pale dots, 8-10 mm long and 7-9 mm in diameter; calyx prominent, with a short tube, a broad shallow cavity narrowed and tomentose in the bottom, and elongated persistent lobes villose and bright red on the upper side; flesh thin, yellow-green, dry and mealy; nutlets 3 or 4, gradually narrowed and rounded, or when 4 acute at the ends, ridged on the back, with a broad high grooved ridge, more or less penetrated on the inner faces by long wide depressions, 6.5-7 mm long, and 4-4.5 mm wide.

A shrub 3-4 m high, with small stems covered with pale gray bark, spreading horizontal and drooping branches, and very slender nearly straight branchlets, light orange-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and very lustrous in the first season and pale gray-green in their third year, and armed with slender nearly straight dark purple spines 4-5 cm long.

Near the road along the east side of Hemlock lake, Livingston co., Henry T. Brown (*11, type), May 28 and October 3, 1906.

This species has the foliage, habit and general appearance of a *Coccineae*. From that group it is excluded by the depressions on the inner faces of the nutlets which are sometimes as much developed as in some of the species of *Tomentosae*. On many of the nutlets these depressions are much less deep than on others, however, and as they show so much variation in this character it is perhaps best to place it among the *Anomala*e, which by the discovery of this species appears to be even more closely related than was before supposed; on one hand with the *Coccineae* and on the other with the *Tomentosae*.

***Crataegus floridula* n. sp.**

Glabrous with the exception of the hairs on the young leaves and calyx lobes. Leaves ovate to oblong-ovate or oval, long-pointed

and acuminate at the apex, gradually narrowed and concave-cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and slightly and irregularly divided usually only above the middle into 3 or 4 pairs of small acute lobes; slightly tinged with red when they unfold, nearly fully grown when the flowers open the first week of June and then very thin, dark yellow-green and slightly hairy above especially along the midribs, and glabrous and glaucous below, and at maturity thin, dark bluish green, smooth and lustrous on the upper surface, pale blue-green on the lower surface, 5-7 cm long and 3-4.5 cm wide, with thin yellow midribs and primary veins; petioles very slender, slightly wing-margined at the apex, sparingly glandular, with mostly deciduous glands, often tinged with red in the autumn, 1.8-2.5 cm in length; leaves on vigorous shoots thicker, occasionally rounded at the base, more coarsely serrated, more deeply lobed, and often 7-8 cm long and 5.5-6.5 cm wide, with foliaceous lunate often persistent stipules. Flowers 1.2-1.3 cm in diameter, on long slender pedicels, in very narrow compact 4-8-flowered corymbs, the much elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes long, slender, acuminate and rose colored at the apex, entire or furnished near the base with 1 or 2 glands, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 5-8; anthers red or purple; styles 3 or 4. Fruit ripening late in September, on slender drooping pedicels, in loose clusters, short-oblong to somewhat obovate, slightly narrowed at the ends, crimson, lustrous, 1.1-1.2 mm long, and 7-8 mm in diameter; calyx little enlarged, with a deep narrow cavity, and reflexed and appressed lobes dark red on the upper side below the middle and often deciduous from the ripe fruit; flesh thin, greenish yellow; nutlets 3 or 4, usually 3, gradually narrowed and rounded at the ends, or when 3 broader at the apex than at the base, marked on the inner face by shallow irregular depressions, 6.5-7 mm long, and about 4 mm wide.

A shrub 2-3 m high, with gray stems, 2.5-5 cm in diameter near the ground, ascending branches, and slender slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming bright chestnut brown and lustrous in their first season and dull reddish brown the following year, and armed with stout slightly curved chestnut brown shining spines 2.5-3 cm long.

Piseco, Hamilton co., C. H. Peck (♂ 62, type), June 10 and September 16, 1904.

TOMENTOSAE

Crataegus efferata n. sp.

Leaves oblong-ovate to rhombic, acute or acuminate at the apex, abruptly or acutely concave-cuneate at the entire base, finely often doubly serrate above, with straight or incurved glandular teeth, and sometimes slightly divided above the middle into 3 or 4 pairs of small acute lobes; more than half grown when the flowers open the last days of May and then very thin, yellow-green and slightly hairy above on the midribs and covered below by soft pale hairs, and at maturity thin but firm in texture, light yellow-green, very smooth and glabrous on the upper surface, pale and villose-pubescent on the lower surface on the stout often rose colored midribs and slender primary veins and veinlets, 5.5-7.5 cm long and 4-6 cm wide; petioles stout, narrowly wing-margined often to the base, hairy on the upper side while young, becoming nearly glabrous and often dark rose color in the autumn, 1.5-1.8 cm in length; leaves on vigorous shoots thicker, more coarsely serrate, more deeply lobed, and often 7-8 cm long and 5-6 cm wide. Flowers about 1.2 cm in diameter, on long slender slightly villose pedicels, in small rather compact 10-15-flowered hairy corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, coated with short white hairs, the lobes abruptly narrowed at the base, long, wide, acuminate, laciniately glandular serrate, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens 16-20; anthers light rose color; styles 2 or 3. Fruit ripening early in October, on long slender slightly hairy red pedicels, in few-fruited spreading or drooping clusters, subglobose, scarlet, very lustrous, marked by large pale dots, 8-9 mm in diameter; calyx prominent, with a deep narrow cavity, and long spreading lobes dark red on the upper side below the middle; flesh thick, yellow-green, becoming soft and succulent when fully ripe; nutlets usually 2, nearly orbicular, rounded and slightly ridged on the back, penetrated on the inner face by long narrow deep cavities, 4.5-5 mm long, and 3-3.5 mm wide.

An arborescent shrub 5-7 m high, with stout stems covered with dark brown scaly bark, erect and spreading branches, and stout slightly zigzag glabrous branchlets light orange-yellow when they first appear, becoming dark chestnut-brown, very lustrous and marked by small pale dark lenticels in their first season and dull reddish brown the following year, and armed with numerous very

stout straight or slightly curved light chestnut-brown shining spines 4-5 cm long, compound and long persistent on old stems and branches.

Banks of the outlet of Hemlock lake at Hemlock railroad station, Livingston co., New York, Henry T. Brown (*6, type), May 28 and October 4, 1906.

***Crataegus honeoyensis* n. sp.**

Leaves oval to ovate or slightly obovate, rounded or acute at the apex, gradually or abruptly narrowed and concave-cuneate at the entire base, sharply doubly serrate above, with straight or incurved glandular teeth, and sometimes slightly divided above the middle into 2 or 3 pairs of short broad acuminate lobes; nearly fully grown when the flowers open in the last week of May and then thin, yellow-green, smooth, lustrous and slightly hairy along the midribs above and pale bluish green and covered below with short soft hairs, and at maturity thick, reticulate-venulose, dull yellow-green, smooth and glabrous on the upper surface, pale and slightly hairy on the lower surface on the stout rose colored midribs, and slender primary veins extending very obliquely to the apex of the leaf, 6-8 cm long and 4-4.5 cm wide; petioles stout, narrowly wing-margined sometimes to the base, slightly hairy on the upper side, often rose color in the autumn, 1.5-2 cm in length; leaves on vigorous shoots rather thicker, ovate or oval, more coarsely serrate, more deeply lobed, and sometimes 8-10 cm long and 5-6 cm wide. Flowers about 1.5 cm in diameter, on long slender drooping villose pedicels, in narrow compact many-flowered corymbs, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, covered with long scattered pale hairs, the lobes long, wide, acute, laciniately glandular serrate, villose, reflexed after anthesis; stamens 20; anthers pale pink, styles 2 or 3, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening the end of September, on stout slightly hairy erect reddish pedicels, in few-fruited clusters, short-oblong or slightly ovate, scarlet, lustrous, marked by small pale dots, 8-10 mm in diameter; calyx prominent, with a broad deep cavity, and elongated spreading persistent lobes slightly hairy and dark red on the upper side; flesh thin, dry and yellow, becoming soft and succulent; nutlets 2 or 3, rounded at the ends, or when 3 acute at the base, ridged on the back, with a low broad slightly grooved ridge, penetrated on the inner faces by shallow cavities, 6-6.5 mm long, and 4-4.5 mm wide.

A narrow shrub 3-4 m high, with small ashy gray stems, ascending branches, and stout slightly zigzag glabrous branchlets light orange-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and very lustrous in their first season and light reddish-brown the following year, and armed with stout straight purplish shining spines 3.5-4 cm long and pointing toward the apex of the branch.

Roadside west of Honeoye lake, Ontario co., New York, H. T. Brown (*35, type), May 28 and October 16, 1906.

REMARKS AND OBSERVATIONS

Aster paniculatus bellidiflorus (Willd.) Burg.

A form answering well to the description of this subspecies was found growing plentifully near the railroad station at Cairo, Greene co. in September.

Carya glabra odorata Sargent

Specimens were collected near Dykemans, Putnam co. June. The leaflets are generally five and the lowest pair are generally much smaller than the pair above them. The fruit is subglobose with a thin husk.

Castanea dentata Borkh.

Fruiting specimens of the remarkable tree near Freehold, Greene co. known as the "burless chestnut" were obtained in September. The fruit at that time was quite small, but the nuts show the exposed manner of their development. The tree is mentioned in Sargent's *Silva of North America*, volume IX, page 14, footnote.

Clitopilus caespitosus Pk.

This rather rare and singular mushroom, has appeared in several localities this season and has shown a wider range of variation than formerly. The pileus varies from 1-4 inches broad and the lamellae from slightly rounded behind or subsinuate to slightly decurrent. The mode of growth is not always strictly caespitose for occasionally single specimens are found. The color of the spores is very similar to that of the spores of *Tricholoma personatum* Fr., *T. nudum* (Bull.) and *T. sordidum* Fr. but in the colors of the plant it is more closely related to *Clitopilus novaboracensis* Pk. another species with very pale pink spores.

Clitopilus conissans Pk.

This species was described from inadequate material collected in a dry time and showing the specific characters imperfectly. Undue weight was given to the red color of the spores and the plant was thereby referred to a genus with which it has but little affinity. Specimens observed and collected this season indicate that its true relationship is with *Psilocybe* on account of the entire absence of a veil and its general habit. Its characters place it near *P. spadicea*, but the plants also have a striking similarity to *Hypoph-*

loma hydrophilum, but from both, the species is separated by the color of the lamellae and spores. A new description follows

***Psilocybe conissans* n. comb.**

Clitopilus conissans N. Y. State Mus. Rep't 41:64; 42:45

Pileus fleshy but thin, broadly convex becoming nearly plane, glabrous, hygrophanous, pale chestnut or watery ferruginous and striatulate on the margin when moist, pale alutaceous or pale buff and sometimes slightly rugose when dry, flesh whitish; lamellae thin, close, rounded behind, adnexed or rarely adnate, bay verging to dark purple or liver color; stem equal, rather slender, firm, glabrous, hollow, curved or flexuous, white, veil none; spores vinaceous, elliptic, .0003-.0004 of an inch long, .00016-.0002 broad, (8-10 μ long, 4-5 μ broad).

Cespitose on or about the base of deciduous trees. Catskill and Adirondack mountains, also at Gansevoort, Saratoga co. September and October. Cystidia occur sparingly on the lamellae.

***Collybia lacunosa* Pk.**

In *New York State Museum Report* 26, page 51 this plant is described under the name *Agaricus (Tricholoma) lacunosus*. Its texture is too tough to permit its reference to the genus *Tricholoma* and it is here placed in the genus *Collybia* as a better place for it. It is a pretty little golden yellow mushroom inhabiting decaying wood. It is neither common nor plentiful.

***Crataegus bissellii* Sargent**

A small shrub whose flowers have pale pink anthers soon fading to pale yellow or whitish was found near Staatsburg, Dutchess co. and referred to this species. A similar shrub but having flowers with bright red anthers occurs in North Greenbush, Rensselaer co. As the anthers of the flowers of *C. bissellii* are described as either pink or rose purple the North Greenbush shrub is also referred to this species.

***Cypripedium arietinum* R. Br.**

Near Hague, Warren co. Mrs E. Watrous. This is a rare species in our State and it is becoming more scarce from year to year. It is therefore gratifying to add this new locality to those previously known. Mrs Watrous sends both flowering and fruiting specimens.

***Erysimum cheiranthoides* L.**

A small form 6-10 inches tall with leaves scarcely more than one inch long was found growing about water holes in a pasture near Clayton, Jefferson co.

***Geoglossum peckianum* Cke.**

Specimens of this rare species were found growing among hair cap mosses near Wading River, Suffolk co. August. A slender form of *Geoglossum nigrum* (Fr.) Cke. was found by S. H. Burnham growing among sphagnum in a marsh near Shushan.

***Habenaria ciliaris* (L.) R. Br.**

This beautiful orchid still lingers near Karner in what appears formerly to have been a swamp hole. It was discovered there two years ago and was in fine flowering condition at that time, July 22. The past season it was in the same flowering condition August 18, illustrating strikingly the influence of the season in retarding the development of vegetation.

***Hydnum septentrionale* Fr.**

The difference between the young plant and the mature one is very great, and to illustrate this difference a figure of each is given on plates 9 and 10 in *Icones Hymenomycetum*. A specimen of the young plant was found near Fine, St Lawrence co. growing on the trunk of a standing sugar maple. It corresponds beautifully with the Friesian figure.

***Hypholoma sublateritium* (Schaeff.) Fr.**

This species has been unusually abundant the latter part of the season. It has, in those cases coming under my observation, shown a darker and more uniformly brownish red color of the cap than is shown in *H. perplexum* Pk. This, taken in connection with its stuffed stem, makes the separation of the two quite easy. Its flavor, however, is not always bitter, as is indicated by the descriptions of the European plant.

***Morchella deliciosa* Fr.**

The name of the delicious morel implies that it is specially agreeable as an article of food. In confirmation of this I am pleased to

make the following quotation from a letter received concerning it. "On two successive days this month, May 1907, I have collected on my lawn in Patterson, N. J. a double handful of *Morchella deliciosa*, had them cooked and have eaten them with the result that they were quite as palatable as the common mushroom." Unfortunately the species is not very common and, like other morels, its time of occurrence is limited to a short period early in the season.

***Polyporus volvatus* Pk.**

This singular species of polyporus inhabits the trunks of various coniferous trees. It emerges from holes made in the bark by insect borers. While young, the pores, from which the spores drop, are concealed by a thin prolongation of the exterior coat of the pileus, which forms a continuous membrane beneath them. In due time the central part of this membrane opens in a circular aperture and reveals the mouths of the pores and the heaps of pinkish spores that have fallen from them and lodged on the inner surface of the membrane about the aperture. Small insects are often found inside the wrapper and apparently feeding on the spores. In some specimens of the polyporus received early in the season small holes were observed in the wrapper and insects were found in the cavity dusted with and evidently feeding on the spores, for there was no evidence of their having eaten or bored into the substance of the fungus. The appearance indicated that the borers had eaten one or two holes through the wrapper before its aperture had been formed and that they had thereby gained entrance to the storehouse of spores on which they were feeding. In the examples in which the insects were found within specimens with no small apertures in the wrapper it is clear that they gained entrance through the larger natural aperture. It is possible that one purpose of the visit of the insects is to deposit eggs within the fungus, for this species of polyporus is one specially liable to be quickly destroyed by insect larvae developing within. Here appears to be a peculiar case of mutual benefit between insect and fungus. The insect bores holes through the bark of the tree. Through these holes the spores of the fungus have access to the sapwood of the tree and through them also the mycelium of the fungus finds an exit to the external light and air where it forms the fruiting body and develops its spores. These in turn furnish food and a place for propagation to insects.

***Salix serissima* (Bail.) Fern.**

A fine clump of this late willow was found growing in a wet place by the roadside near Fulton Chain, Herkimer co. This is the third station known for it in the Adirondack region.

***Sphaeronema pruinosa* Pk.**

On the trunk of the low June berry, *Amelanchier spicata* (Lam.) Dec. Arnold clearing near Fulton Chain. June. This rare fungus was published in *New York State Museum Report* 24, page 85. 1872. Apparently the same species was published under the same name by Berkeley and Curtis in *Grevillea* 2:177. 1874.

EDIBLE FUNGI***Lycoperdon subincarnatum* Pk.****PINKISH PUFFBALL****PLATE 114, FIG. 1-6.**

Gregarious or cespitose; peridium 6-12 lines broad, globose or subglobose, sessile, the surface covered with small close subpyramidal granular or spiny warts which in the mature plant fall, leaving minute pits in the surface of the inner peridium, pinkish brown; capillitium and spores olivaceous; spores globose, .00016-.0002 of an inch broad.

The pinkish puffball is found in woods, growing on decaying wood, stumps, and prostrate trunks of trees and may be found from July to September. It is peculiar to this country. It rarely exceeds one inch in diameter and except when growing in dense clusters it is quite regularly globose and either sessile or with a very short sterile base. It is easily distinguished by its dull pinkish brown color and sessile peridium while immature, and by the grayish minutely pitted inner peridium of the mature or old plants. It is well to remove the exterior peridium before cooking. The texture is a little tough and the flesh is not highly flavored, but when fried in butter it is agreeable to the taste, digestible and harmless. No puffball should be eaten after its flesh has lost its white color.

Lycoperdon gemmatum* Batsch*STUDDED PUFFBALL****PLATE 114, FIG. 7-15**

Scattered, gregarious or cespitose; peridium 10-20 lines broad, globose, depressed globose or obovate, obtuse or umbonate, generally

abruptly narrowed below into a more or less stemlike base, the surface covered with warts of unequal size, the larger ones solid, conic or pyramidal, bluntly pointed, early deciduous, intermingled with smaller granular and more persistent ones, where falling leaving small pale dotlike spots on the inner peridium, about which the smaller warts form rows of minute dots, white, whitish, grayish or brownish, the apex or umbo sometimes more highly colored than the rest, the old denuded peridium grayish, brownish or cinereous, often retaining the dotlike spots for a long time; capillitium and spores olivaceous; spores globose, .00016 of an inch broad.

The studded puffball grows on the ground and on decaying wood, in woods, groves and open places and may be found from June to October. It is a common and a very variable species. It is readily distinguished from all our other species by the peculiar character of its larger gemlike warts and the pale dots they leave on the inner peridium when they have fallen. The anastomosing rows of the smaller warts often give a reticulate appearance to the surface. The stemlike sterile base is sometimes cylindrical and nearly equal in diameter to the diameter of the peridium, sometimes it is much more narrow and again it may gradually taper downward. In some cases it is very short or wanting, in others it exceeds the peridium in length. In large specimens it may be coarsely pitted at the top or plicately grooved, the grooves often extending upward and forming plications on the base of the peridium. In some specimens both the grooves and pits occur. The larger warts are usually more numerous and conspicuous on the upper half of the peridium and are smaller and more scattered toward the base. Sometimes they are tipped with black or brown, and in some specimens they are more closely placed than in others.

The outer coat should be removed before cooking. In the raw state the taste is disagreeable, but cooking destroys this and makes a very palatable dish of this common puffball.

***Clitocybe subcyathiformis* n. sp.**

SAUCER CLITOCYBE

PLATE IIO, FIG. I-6

Pileus fleshy but thin, broadly convex or nearly plane becoming centrally depressed, glabrous, hygrophanous, watery white when

moist and often obscurely striatulate on the thin soon spreading margin, white when dry, sometimes slightly colored in the center, flesh white, taste mild; lamellae thin, moderately close, adnate or slightly decurrent, white or whitish; stem equal or slightly tapering upward, stuffed, fibrillose-reticulate, whitish, often with a whitish mycelioid tomentum at the base; spores elliptic, .00024-.0003 of an inch long, .00016-.0002 broad.

The saucer clitocybe is gregarious and grows among fallen leaves under alders and white birches, and occurs late in the season. Its cap is 1-2 inches broad; its stem 1-1.5 inches long and 2-4 lines thick. It is generally white throughout. In the character of the stem the species is related to the cup shaped clitocybe, *C. cyathiformis* Fr., but in its white color, in its thin quickly expanding margin, and closer gills it is more closely related to *C. dealbata* Sow. The central depression of the cap is partly due to the elevation of the thin margin. The upper surface of the cap is therefore concave or saucer shaped and does not become funnel form. The margin is sometimes wavy or irregular. The small size and rarity of the species detracts from its importance as an edible species, but its agreeable flavor and harmless character make it worthy of a place in our list of edible species.

Collybia dryophila (Bull.) Fr.

OAK LOVING COLLYBIA

PLATE III, FIG. I-II

Pileus thin, convex or nearly plane, sometimes depressed in the center with the margin elevated and often wavy or irregular, glabrous, obtuse, variable in color, pale alutaceous, yellowish, dark tan or chestnut, flesh white; lamellae thin, close, narrow, rounded behind, slightly adnexed or nearly free, white or whitish, rarely tinged with yellow; stem equal, thickened toward the base or bulbous, glabrous, hollow, commonly colored like the pileus; spores elliptic, .00024-.0003 of an inch long, .00012-.00016 broad.

The oak loving collybia is one of our most common mushrooms. It occurs in woods, groves, open places and pastures and appears at any time from early spring to late autumn, when there is a sufficient degree of warmth and moisture. A favorite place of growth for it is among fallen pine leaves or under pine trees. It also grows on decaying wood. It may be solitary, gregarious or tufted. In dense tufts the caps are usually very irregular on account of mutual

pressure. They are 1-3 inches broad, the stem 1-3 inches long and 1-3 lines thick. The flesh is slightly tough but agreeable to the taste and perfectly harmless.

***Russula pusilla* Pk.**

SMALL RUSSULA

PLATE 110, FIG. 7-14

Pileus very thin, convex or nearly plane, sometimes slightly or umbilicately depressed in the center, glabrous, even or slightly striate on the margin, red, often darker in the center, flesh white, taste mild; lamellae broad, moderately close, subventricose, adnate or slightly rounded behind, white becoming yellowish ochraceous or ochraceous buff with age or in drying; stem stout, solid or spongy within, soft, white; spores globose, slightly tinged with yellow, .0003 of an inch broad.

The small russula is not common but it sometimes occurs in considerable quantity and may be found from July to October. In the typical form the cap is less than an inch broad and the stem less than an inch long, but in specimens sent me by an esteemed correspondent and enthusiastic mycologist, Mr E. B. Sterling, the caps range from 3 lines to 2 inches broad, but the stem is in no case more than an inch long. The color of the caps is dark red or crimson, usually darker or brownish in the center. The coloring matter is soluble in water. If the plants are washed in water, the water becomes red, if stewed in milk without previous washing the milk becomes red, but this does not detract from the flavor and edibility of the mushroom. The pellicle of the pileus is separable and when wet, appears to be viscid, but in the growing condition of the mushroom the viscosity is not apparent. The plants grow on the bare soil or among short grass under pine trees. Mr Sterling writes concerning them that they have been very abundant between October 2 and October 11 and that on the afternoon of the latter date under two pine trees he collected for the table 120 specimens. He says "I consider them without doubt the best of the *Russula* family for eating. They taste good raw and when fried in butter, flavored and served hot, are delicious." Through his kindness I have had the opportunity of testing the edibility of this rare little mushroom and have no hesitation in placing it in the list of our excellent edible species,

Crepidotus malachus B. & C.

SOFT SKINNED CREPIDOTUS

PLATE 112, FIG. 1-4

Pileus fleshy, thin on the margin, thicker at the base, reniform, orbicular, cuneate or flabellate, convex or nearly plane, sometimes depressed behind, sessile or with a very short inconspicuous white tomentose stem, glabrous or slightly tomentose at the base, hygrophanous, watery white or grayish white and striatulate on the thin margin when moist, white when dry, flesh white; lamellae thin, close, rounded behind, white or whitish becoming brownish ferruginous; spores globose, .00025-.0003 of an inch broad.

The soft-skinned crepidotus is a common species and grows on damp decaying wood in woods or shaded places. Much decayed prostrate mossy trunks of trees constitute a favorite habitat for it. It may be scattered, gregarious or imbricated in its mode of growth. It occurs from June to September. The cap is 1-2.5 inches broad and is sessile, or if it has a stem this is so short that the cap appears from above to be sessile. In wet weather or after rain it has a water soaked appearance and slight shadowy striations on the margin. As the moisture escapes, the cap becomes a clearer white and the striations disappear. The moisture disappears from the thickest part of the cap first, the thinnest part last. The species may be separated from our other white and closely allied forms by its more glabrous cap and globose spores.

Stropharia bilamellata Pk.

DOUBLE GILLED STROPHARIA

PLATE 112, FIG. 5-10

Pileus fleshy, convex, becoming nearly plane in large plants, even, obtuse, glabrous, whitish or yellowish, flesh white; lamellae thin, close, adnate, purplish brown in the mature plant; stem commonly short, solid, sometimes hollow in large plants, white, annulate, the annulus thick, white, with lamellae on the upper surface; spores elliptic, .0004-.0005 of an inch long, .0002-.0003 broad.

The double gilled stropharia is a rare species of which the first specimens received were collected in California. A second collection, of which samples were received, was made in Washington, D. C., and a third which enabled me to test its edibility was received

from Newark, Wayne co. where it was found growing in a cultivated field.

The species is well marked by the peculiar character of its collar. On the upper surface are miniature gills which radiate from the stem to the margin of the collar. These are narrow, white and uneven or dentate on the margin. They are sometimes stained by the spores, but these have probably fallen from the true gills above. In some instances the inner extremity of the false gills extends upward on the stem and appears to connect with the gills above. This peculiar character of the collar seems to be shown in *Stropharia coronilla* (Bull.) Fr. and forcibly suggests the thought that our plant is specifically the same as the European. The two correspond in several other characters and were there not several discrepancies between the American plant and the description of the European there could be no doubt of their specific unity. The following comparison shows the differences.

	AMERICAN	EUROPEAN
Pileus	white or yellowish	Tawny, ochraceous
Stem	solid or hollow, equal, or tapering upward	Stuffed, tapering downward
Collar	broad, white, gills on the upper surface	Narrow with radiating violaceous striae or upper surface sulcate plicate
Gills	without cystidia	With cystidia
Spores	10-12 μ x 6-8 μ	10 μ x 5 μ

On account of these differences it has seemed best to consider our plant distinct from the European, though it must be acknowledged that the similarity in the peculiar and unusual character of the gills almost outweighs the discrepancies between our plant and the descriptions of the European.

The cap is white or yellowish, glabrous, obtuse, the flesh is white and our plant, like the European, has a peculiar or radishlike odor. The mature gills are purplish brown with a white edge. The stem is commonly solid, but in large or old specimens it is sometimes clearly hollow. It is equal in diameter or tapering upward.

***Boletus niveus* Fr.**

SNOWY BOLETUS

PLATE 113, FIG. 1-5

Pileus fleshy, convex, becoming broadly convex or nearly plane, glabrous, white or grayish white, flesh white; tubes nearly plane in

the mass, becoming convex with age, depressed around the stem, their mouths minute, whitish when young, becoming brownish with age; stems long, rather slender, equal or tapering upward, solid, scurfy or appressed scaly, grayish; spores oblong-fusiform, .0005-.0008 of an inch long, .0002-.00024 broad.

The snowy boletus is so closely related to the scabrous stemmed boletus that it is treated as a variety of it in *Hymenomyces Europaeae*. But it has recently been raised again to specific rank. It differs from the scabrous stemmed boletus not only in the color of its cap but also in its smaller tube mouths and in the character of its stem which lacks the fibrous black or reddish points which so distinctly mark *B. scaber*. Sometimes the whitish cap becomes tinged with green or bluish green, specially on the margin. The species is rare, having been observed and collected by the writer twice only, and both times in one locality. It occurs in August and is gregarious in its mode of growth. Its cap is 2-4 inches broad, its stem 3-5 inches long and 3-6 lines thick. Its edible qualities are similar to those of the scabrous stemmed boletus.

NEW YORK SPECIES OF PHOLIOTA

Pholiota Fr.

The genus *Pholiota* belongs to the series *Ochrospora* which is characterized by spores of an ochraceous or subferruginous color. It is not in all cases sharply limited from allied genera because of the varying character of some of its species. It corresponds in structure to *Armillaria* in the white spored series and *Stropharia* in the brown spored series. In the group *Phaeotae* of the terrestrial species the spores are brown enough to cause some difficulty in deciding whether a given species should be placed in *Pholiota* or *Stropharia*. The variability in the development of the veil may also cause some perplexity. Species in which the veil is but slightly developed and very fugacious are liable to be referred to the genus *Flammula* or *Naucoria*. In *Pholiota ornella* Pk. the remains of the slight veil are so conspicuously adherent to the margin of the pileus as to suggest a reference to the genus *Hypoholoma* unless the spore color is carefully noted. The prominent characters of the genus are:

Hymenophorum continuous with the stem; lamellae attached to the stem; stem annulate.

Some of the species grow on the ground, but the greater number grow on dead or decaying wood.

KEY TO THE SPECIES

- Plants terrestrial. 1
- Plants lignatile 12
- Plants growing on or among mosses. minima
- 1 Spores ferruginous 2
- 1 Spores fuscoferruginous 5
 - 2 Pileus 2 inches or more broad. caperata
 - 2 Pileus less than 2 inches broad. 3
- 3 Pileus hygrophanous rugosa
- 3 Pileus not hygrophanous. 4
 - 4 Pileus slightly striate on the margin. filaris
 - 4 Pileus even on the margin. togularis
- 5 Pileus squamulose angustipes
- 5 Pileus glabrous 6
 - 6 Pileus viscid when moist. aggericola
 - 6 Pileus not viscid. 7
- 7 Pileus subochraceous 8
- 7 Pileus not subochraceous. 9
 - 8 Annulus persistent, lamellae very broad. temnophylla
 - 8 Annulus fugacious, lamellae narrow. howeana
- 9 Stem solid johnsoniana
- 9 stem hollow 10
 - 10 Pileus white, commonly rimose areolate. vermiflua
 - 10 Pileus not pure white, commonly even. 11
- 11 Spores more than .0003 of an inch long. praecox
- 11 Spores less than .0003 of an inch long. duroides
 - 12 Pileus and stem squamose or squamulose. 13
 - 12 Pileus alone squamose or squamulose. 18
 - 12 Pileus neither squamose nor squamulose. 21
- 13 Pileus viscid when moist. 14
- 13 Pileus not viscid. 16
 - 14 Pileus with red or purple hues when young. ornella
 - 14 Pileus with no red or purple hues. 15
- 15 Pileus brown or yellowish brown. albocrenulata
- 15 Pileus bright yellow. adiposa
- 15 Pileus lemon yellow. limonella
- 15 Pileus whitish with dense tawny erect scales. squarrosoides
 - 16 Pileus more than 1 inch broad. 17
 - 16 Pileus not more than 1 inch broad. erinaccella
- 17 Pileus with squarrose tawny scales. squarrosa
- 17 Pileus with superficial pale yellow scales. flammanus
 - 18 Pileus viscid when moist. comosa
 - 18 Pileus not viscid. 19
- 19 Annulus well developed, persistent. spectabilis
- 19 Annulus slight, fugacious. 20
 - 20 Stem hollow. curvipes
 - 20 Stem solid luteofolia
- 21 Pileus dry. lutea
- 21 Pileus hygrophanous. 22

22	Pileus more than 2 inches broad.....	23
22	Pileus not more than 2 inches broad.....	24
23	Pileus when dry cinnamon or ferruginous.....	cerasina
23	Pileus when dry yellow.....	acericola
24	Pileus viscid when moist.....	discolor
24	Pileus not viscid.....	25
25	Pileus yellow when dry.....	autumnalis
25	Pileus tawny when dry.....	confragosa
25	Pileus whitish or yellowish buff when dry.....	marginella

TERRESTRIAL

*Spores ferruginous***Pholiota minima** Pk.

SMALLEST PHOLIOTA

Pileus membranous, hemispheric or campanulate, umbonate, glabrous, hygrophanous, brown and striatulate on the margin when moist, pale buff or yellowish white when dry; lamellae rather close, subventricose, adnexed, ferruginous; stem slender, glabrous, solid, shining, similar to the pileus in color, annulus near the middle, slight, evanescent; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 2-4 lines broad; stem 8-12 lines long, .25 line thick.

Among hair cap mosses, *Polytrichum*. Catskill mountains. September. An extremely small species and a very rare one. It was discovered 20 years ago and has not been found since. It is separable from *Pholiota mycenoides* Fr. by its smaller size, paler color, umbonate pileus and solid stem. The umbonate pileus also separates it from *P. pumila* Fr.

Pholiota caperata (Pers.) Fr.

WRINKLED PHOLIOTA

State Mus. Rep't 54. p.182, pl.73, fig.1-5.

Pileus fleshy, firm, thin toward the margin, ovate becoming broadly campanulate or convex, obtuse, glabrous or often whitened in the center by whitish flocci or silky fibrils, generally more or less wrinkled, yellow, flesh white; lamellae moderately close, adnate, often uneven on the edge, whitish becoming ferruginous; stem equal, solid, stout, sometimes bulbous, glabrous or slightly floccose, white or whitish, the membranous annulus white, thick on the edge; spores subelliptic, .0005-.0006 of an inch long, .00025-.0003 broad.

Pileus 2-4 inches broad; stem 2-5 inches long, 5-10 line thick.

Scattered or somewhat gregarious, in woods, mossy swamps and open places. July to October. Common. Edible.

This is a fine large pholiota easily recognized by its peculiar wrinkled pileus and the white pruinosity or floccose covering of the center of the pileus. Sometimes, however, specimens may occur in which neither the wrinkles nor the flocci are present. Occasionally there is the semblance of a volva at the base of the stem. The annulus is usually well developed, white and persistent.

Pholiota rugosa Pk.

RUGOSE PHOLIOTA

Pileus thin, broadly conic or campanulate becoming expanded and often umbonate, hygrophanous, yellowish red or ferruginous and striatulate on the margin when moist, pale yellow or buff and commonly rugose when dry; lamellae close, adnexed, minutely denticulate on the edge, yellowish white becoming ferruginous or brownish ferruginous, the interspaces venose; stem equal or slightly thickened toward the base, straight or flexuous, hollow, fibrillose or squamulose below the annulus, pruinose or mealy above, pallid, the annulus membranous, with radiating ridges or striations on the upper surface, white; spores .0004-.0005 of an inch long, .00024-.00028 broad.

Pileus 6-12 lines broad; stem 1-2 inches long, 1-2 lines thick.

Ground and among decaying chips. Adirondack region. September. The species is closely related to *Pholiota togularis* (Bull.) Fr. from which it is separated by the hygrophanous pileus, the adnexed lamellae and the peculiar striations of the annulus.

Pholiota filaris (Fr.) Pk.

THREAD STEM PHOLIOTA

Pileus submembranous, campanulate becoming broadly convex or nearly plane, obtuse, even, but slightly striate on the margin, ochraceous; lamellae thin, close, adnate, ventricose, yellow becoming pale ferruginous; stem filiform, flexuous, glabrous, pallid, the annulus well developed, distant, white; spores .0003 of an inch long, .0002 broad.

Pileus 4-6 lines broad; stem 1-2 inches long, scarcely half a line thick.

Woods and open places. Adirondack and Catskill mountains. August. This is closely related to the next following species, with which it was united as a variety by the illustrious Fries. It may be separated by its smaller size, and the slightly striate margin of the pileus.

***Pholiota togularis* (Bull.) Fr.**

LITTLE CLOAK PHOLIOTA

Pileus thin, campanulate becoming nearly plane, orbicular, obtuse, glabrous, even, not striate on the margin, pale ochraceous; lamellae thin, close, adrate, ventricose, yellow becoming pale ferruginous; stem equal, hollow, slender, fibrillose, yellow at the top, brownish toward the base; spores .0003 of an inch long, .0002 broad.

Pileus 10–15 lines broad; stem 2–3 inches long, 1–2 lines thick.

Ground in woods. Adirondack mountains. August. This and the two preceding species may yet be found to be varieties of one very variable species. They are closely allied to each other but may be distinguished by the characters given.

Spores fusco-ferruginous

***Pholiota angustipes* Pk.**

NARROW STEM PHOLIOTA

Pileus fleshy, hemispheric becoming convex or nearly plane, slightly viscid when moist, squamulose with minute dotlike appressed scales, brown or grayish brown becoming ochraceous brown or sub-alutaceous, flesh whitish, taste unpleasant; lamellae thin, close, sinuate, whitish or creamy yellow becoming tawny brown; stem equal or tapering downward, flexuous, stuffed or hollow, squamose, whitish or cinereous; spores naviculoid, .0003 of an inch long, .00016–.0002 broad.

Pileus 1–2.5 inches broad; stem 1.5–3 inches long, 2–3 lines thick.

Cespitose. In pastures, commonly near or around old stumps. Otsego and Albany counties. July to October.

This species is related to the European *Pholiota terrigena* Fr. and *Pholiota punctulata* Kalchb. but from both it differs in the darker color of the pileus and in its slight viscosity. By reason of its densely tufted mode of growth the caps are often closely crowded and irregular.

***Pholiota aggericola* Pk.**

BROWN PHOLIOTA

Pileus fleshy, convex becoming nearly plane or slightly depressed in the center by the upcurving of the margin, glabrous, viscid when moist and slightly striatulate on the margin, brown or blackish brown, sometimes darker in the center; lamellae subdistant, sinuate, decurrent with a tooth, pallid or grayish becoming rusty brown; stem equal or slightly tapering upward, fibrous, solid, colored like or a little paler than the pileus, whitish above the membranous annulus; spores elliptic, .0004-.0005 of an inch long, .00024 broad.

Pileus 1-2 inches broad; stem 1.5-3 inches long, 2-4 lines thick.

Banks by roadsides and among fallen leaves in woods. Albany county and Adirondack mountains. July to October. The pileus sometimes fades to a rusty brown hue.

P. aggericola retirugis Pk. Pileus rugosely reticulated.

Pholiota indecens Pk. is probably not distinct from this species, it differing in its dry pileus. This possibly was due to its being collected in a dry time. It has been collected but once.

***Pholiota temnophylla* Pk.**

CUT GILLED PHOLIOTA

Pileus fleshy, hemispheric becoming convex, smooth, ochraceous yellow; lamellae very broad, adnexed, obliquely truncate at the inner extremity, brownish ferruginous; stem equal, glabrous, hollow, white, the annulus well developed, membranous, white; spores brownish ferruginous, broadly elliptic, .0004-.0005 of an inch long, .0003-.00035 broad.

Pileus 1-2 inches broad; stem 2-4 inches long, 2-4 lines thick.

Grassy ground by roadsides. Rensselaer county. June.

In color this species resembles *Naucoria semiorbicularis* (Bull.) Fr. but its annulus at once separates it from that. It also approaches *Pholiota praecox* (Pers.) Fr. in some respects, but its large size and peculiar broad lamellae are distinguishing characters. It has been found but once.

Pholiota howeana Pk.

HOWE PHOLIOTA

Pileus convex becoming nearly plane, fragile, smooth, subumbonate, yellowish, sometimes darker in the center; lamellae thin, close, rounded behind, eroded on the edge, whitish becoming ferruginous brown; stem equal or slightly thickened at the base, glabrous, hollow, colored like the pileus; spores .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 1-3 inches broad; stem 2-4 inches long, 2-4 lines thick.

Ground in woods and bushy places. Adirondack mountains, Albany and Sullivan counties. June, July and August. This species was formerly referred doubtfully to the genus *Stropharia*, but it now seems better to put it in *Pholiota*.

Pholiota johnsoniana Pk.

JOHNSON PHOLIOTA

Pileus fleshy, soft, brittle, broadly convex or nearly plane, glabrous, thin on the margin and sometimes striatulate when moist, yellowish in the center, whitish on the margin, sometimes wholly yellowish, flesh white, flavor agreeable; lamellae thin, close, rounded behind, slightly adnexed, whitish becoming rusty brown; stem equal, glabrous, solid, slightly striate at the top, the annulus thick, white; spores brown with a slight ferruginous tint, .00024-.0003 of an inch long, .00016-.0002 broad.

Pileus 2-4 inches broad; stem 1.5-3 inches long, 3-5 lines thick.

Grassy ground in pastures. Not common. Albany and Essex counties. September.

The spores of this species have such a decidedly brown hue that the species was thought to belong to the genus *Stropharia*. But in a good light a slight rusty tint can be detected. It is therefore placed with the brownish ferruginous spored species of *Pholiota*.

Pholiota vermiflua Pk.

WORMY PHOLIOTA

State Mus. Bul. 75. p.32, pl.86, fig.12-20.

Pileus convex or nearly plane, glabrous or sometimes floccose on the margin, commonly rimose areolate, specially in the center, white,

sometimes slightly tinged with yellow, flesh white; lamellae close, adnexed, white becoming ferruginous brown, generally minutely eroded on the edge; stem equal, hollow, striate at the top, white, the white annulus more or less floccose on the lower surface, lacerated, often evanescent; spores .0005 of an inch long, .0003 broad.

Pileus 2-4 inches broad; stem 2-3 inches long, 3-5 lines thick.

Rich soil in grain fields, waste places and about manure heaps. Albany, Essex and Monroe counties. June, July and August. Edible.

From the early *pholiota*, to which it is related, it may be separated by its larger size, thicker flesh, stouter stem, whiter color and by the greater tendency of the surface of the pileus to crack into areas.

***Pholiota praecox* (Pers.) Fr.**

EARLY PHOLIOTA

State Mus. Mem. 4. p.159, pl.57; fig.1-5.

Pileus convex or nearly plane, soft, glabrous, whitish, often tinged with yellow or tan color, flesh white; lamellae thin, close, adnexed, whitish becoming brownish or rusty brown; stem slender, equal, glabrous or slightly mealy when young, stuffed or hollow, whitish, the annulus white, entire, sometimes fugacious; spores .0004-.0005 of an inch long, .00024-.0003 broad.

Pileus 1-2 inches broad; stem 1.5-3 inches long, 2-2.5 lines thick.

Grassy ground, lawns, etc. Common. May to July. Edible.

Pholiota praecox minor (Batt.) Pileus scarcely more than 1 inch broad, its margin appendiculate with the remains of the veil, annulus generally wanting. Grassy places. State Mus. Mem. 4, p. 160, pl.57, fig. 6-8.

Pholiota praecox sylvestris Pk. Pileus convex, glabrous, whitish, brown or rusty brown in the center. In thin woods. State Mus. Mem. 4, p. 160, pl. 57, fig. 9-11.

***Pholiota duroides* n. sp.**

HARDISH PHOLIOTA

Pileus thin, convex becoming nearly plane, glabrous or slightly rimose squamose in the center, varying in color from creamy white to ochraceous buff either wholly or in the center only, flesh white, taste mild; lamellae thin, close, narrow, adnexed, sometimes broadly

sinnate and having a decurrent tooth, whitish becoming brown or rusty brown; stem equal or nearly so, stuffed or hollow, glabrous, whitish, the annulus thick and cottony, often lacerated and evanescent, white; spores broadly elliptic, .00024-.00028 of an inch long, .00016-.0002 broad.

Pileus 1-2 inches broad; stem 1-2 inches long, 2-4 lines thick.

Rocky ground near Syracuse. August and September. G. E. Morris, who has found it both in the locality given and in Massachusetts.

It is similar to *Pholiota dura* (Bolt.) Fr. but may be separated from it by its different colors, softer substance and specially by its smaller spores. These are more brown than the spores of *Pholiota praecox* Pers. and make it doubtful whether the species would not better be placed in the genus *Stropharia*.

LIGNATILE

Pileus viscid or dry, not hygrophaneous

Pholiota albocrenulata Pk.

CRENULATE PHOLIOTA

Pileus fleshy, firm, convex or campanulate, obtuse or umbonate, viscid, squamose, yellowish brown, the scales brown or blackish, floccose, easily separable; lamellae broad, subdistant, sinuate, white crenulate on the edge, grayish becoming ferruginous; stem firm, equal or slightly tapering upward, stuffed or hollow, squamose, pallid or brownish below the slight fugacious annulus, white and furfuraceous above; spores subelliptic, pointed at the ends, .0004-.0005 of an inch long, .00024-.0003 broad.

Pileus 1-3 inches broad; stem 2-4 inches long, 2-5 lines thick.

Base of trees or on prostrate trunks and decaying wood, specially of sugar maple, *Acer saccharum* L. Essex and Otsego counties. July and August.

This species is rare and somewhat variable. It is never abundant and often solitary in its mode of growth. The scales of the pileus sometimes disappear leaving the surface of the cap mottled with brown spots. Under a lens the edge of the lamellae appear as if beaded with minute white globules. The margin of the pileus is sometimes adorned by the adhering fragments of the veil.

Pholiota adiposa Fr.**FAT PHOLIOTA**

State Mus. Mem. 4. p. 160, pl. 57, fig. 12-17.

Pileus fleshy, firm, hemispheric or broadly conic becoming convex, viscid or glutinous, squamose, yellow, flesh whitish; lamellae close, adnate, yellow or yellowish becoming ferruginous; stem equal or slightly thickened at the base, solid or stuffed, squamose, yellow or sometimes reddish or tawny toward the base, the annulus slight, floccose, fugacious; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 1-4 inches broad; stem 2-4 inches long, 3-6 lines thick.

Single or caespitose. Stumps and dead trunks of trees in or near woods. Not rare. September to November. Edible.

The scales of the pileus are easily separable and sometimes disappear with age. They are generally more highly colored than the pileus. The annulus is often absent in mature specimens and by no means conspicuous in young ones.

Pholiota limonella Pk.**LEMON COLORED PHOLIOTA**

Pileus thin, convex or nearly plane, sometimes umbonate, viscid, squamose, lemon yellow; lamellae narrow, close, rounded behind, adnexed, whitish becoming ferruginous; stem equal, solid, squamose with recurved scales, smooth above the lacerated annulus, colored like or a little paler than the pileus; spores elliptic, .0003-.00035 of an inch long, .0002-.00024 broad.

Pileus 1-2 inches broad; stem 1.5-2.5 inches long, 2-3 lines thick.

Cespitose. Prostrate trunks of beech, *Fagus americana* Sweet, in woods. Delaware county. September. This is a very beautiful species of pholiota, but it is as rare as it is beautiful. It has been found but once. It is easily distinguished from its allies by its bright lemon yellow color.

Pholiota squarrosoides Pk.**SHARP SCALE PHOLIOTA**

State Mus. Mem. 54. p. 183, pl. 73, fig. 6-15.

Pileus fleshy, firm, subglobose when young, then convex, viscid, squamose, the scales terete, erect, pointed, tawny, densely crowded in the center, scattered toward the margin, there revealing the whitish

color of the pileus, flesh white; lamellae close, sinuate, whitish becoming brownish ferruginous; stem equal, firm, solid or stuffed, rough with numerous recurved tawny scales below the floccose or lacerated annulus, smooth and white above; spores elliptic, .0002 of an inch long, .00016 broad.

Pileus 1-4 inches broad; stem 2-4 inches long, 3-5 lines thick.

Single or cespitose. Old stumps and prostrate trunks of deciduous trees. Edible. Of excellent flavor.

P. squarrosoides faginea Pk. Plant smaller than in the type and scales more scattered. On dead trunks of beech, *Fagus americana* Sweet.

The sharp scale *pholiota* may be distinguished from *Pholiota squarrosa* Müll. by its viscid pileus, its compact, erect, pointed scales, its sinuate lamellae and its smaller brownish ferruginous spores.

***Pholiota ornella* Pk.**

ORNATE PHOLIOTA

Agaricus (Hypholoma) ornellus Pk. State Mus. Rep't 34. p. 42. *Pholiota appendiculata* Pk. State Mus. Bul. 94. p. 33, pl. P, fig. 8-17.

Pileus fleshy, firm, convex or nearly plane, viscid when moist, shining, squamose with appressed spotlike scales, appendiculate with fragments of the veil, dark red when young, soon fading to pink, finally becoming yellowish brown or grayish brown, flesh at first purplish red, specially in the lower part, whitish or pale yellow when mature; lamellae thin, close, rounded behind, adnexed or decurrent with a tooth, pale yellow or almost white becoming brownish ferruginous; stem short, firm, solid or with a small cavity, white above, brownish and squamose below the slight fugacious annulus, white within, the veil white or pale yellow, at first concealing the young lamellae, soon breaking into fragments and adhering partly to the margin of the pileus and partly to the stem; spores .00024-.0003 of an inch long, .00016-.0002 broad.

Pileus 1-3 inches broad; stem 1-1.5 inches long, 2-4 lines thick.

Single or in tufts. Decaying wood and sawdust. Adirondack region, Saratoga and Tompkins counties. July to October.

This is a rare species with us and a very perplexing one. The annulus in its best development consists of a mere circle of scales around the upper part of the stem. The greater part of the veil usually adheres to the margin of the pileus. The species has some characters suggestive of *Flammula polychroa* Berk. from which, however, it may be separated by its squamose pileus

without any umbo, its more fully developed and white or yellowish veil and its differently colored and adnexed lamellae. From the appendiculate margin it was referred to the genus *Hypholoma*. Specimens collected later and having a better developed annulus were described as a *Pholiota*. The viscid pileus with its spotlike scales and appendiculate margin and red, pink or purplish hues, fading with age to grayish brown or yellow brown, are characteristic of the species.

***Pholiota erinaceella* Pk.**

BRISTLY PHOLIOTA

Agaricus deterrentis Pk. State Mus. Rep't 28. Bot. ed. p. 49.

Pileus thin, hemispheric or convex, dry, densely coated with small erect separable pyramidal or spinelike scales, tawny brown; lamellae broad, close, adnexed, pallid becoming cinnamon brown; stem equal, stuffed or hollow, densely squamulose below the slight annulus, often curved, colored like the pileus; spores naviculoid, .0003-.00035 of an inch long, .00016-.0002 broad.

Pileus 6-12 lines broad; stem 6-12 lines long, 1 line thick.

Dead and decaying trunks of deciduous trees in woods. Adirondack mountains, Schoharie and Oneida counties. June to September.

The small soft crowded scales of the pileus, which are easily rubbed away, constitute a prominent character of this species. The annulus is little more than the abrupt termination of the scaly coating of the stem. The name under which the species was first described was found to be preoccupied. This made it necessary to give it another name, and the one here given was chosen.

***Pholiota squarrosa* Müll.**

SCALY PHOLIOTA

Pileus fleshy, firm, broadly conic becoming convex or nearly plane, dry, covered with tawny squarrose scales, yellowish or yellowish brown; lamellae narrow, close, adnate or slightly decurrent, pallid becoming ferruginous; stem equal or nearly so, often flexuous, solid or stuffed, adorned with recurved scales, pallid or tawny brown; spores .0003 of an inch long, .00016 broad.

Pileus 1-3 inches broad; stem 3-5 inches long, 3-5 lines thick.

Prostrate trunks of trees in woods. Adirondack mountains and Rensselaer county. August.

A variable and showy species growing chiefly in dense tufts. The scales of the pileus give it a very rough appearance, specially in the young plant.

***Pholiota flammans* Fr.**

YELLOW SCALE PHOLIOTA

Pileus fleshy, thin, convex becoming nearly plane, dry, sometimes umbonate, yellow or tawny yellow, adorned with paler yellow superficial scales, flesh yellowish; lamellae thin, close, rounded behind, adnexed, yellow becoming ferruginous; stem equal, straight or flexuous, squamulose, stuffed or hollow, yellow; spores minute, elliptic, .00016-.0002 of an inch long, .00012-.00015 broad.

Pileus 1-2 inches broad; stem 2-3 inches long, 2-3 lines thick.

Decaying wood and prostrate trunks of trees in woods. Adirondack mountains. August and September.

The yellow scale pholiota is one of our most beautiful species. Its deep yellow or tawny pileus adorned with the paler sulfur colored delicate scales is an attractive sight. The plants grow singly or in tufts.

***Pholiota comosa* Fr.**

HAIRY PHOLIOTA

Pileus fleshy, firm, convex, obtuse, viscid, squamose with hairy or floccose superficial separable white scales, tawny, flesh compact, white; lamellae broad, slightly decurrent, white becoming brownish clay color; stem somewhat bulbous at first, becoming elongated with age, often curved, solid, fibrillose, whitish, the annulus floccose, soon disappearing; spores brownish ferruginous, elliptic, .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 3-4 inches broad; stem 2-4 inches long, 6-12 lines thick.

Decaying wood of deciduous trees. Monroe county.

The hairy pholiota is a rare species in our State. The locality given is the only one in which the species has been found in our limits. It is doubtful if the variety *alb. a. Pk.* [*State Mus. Rep't* 38, p. 86] belongs to it. It neither agrees in color nor in the size of the spores with the typical form. The specimen from Pittsford, Monroe co. is paler than the European plant but in other respects it shows the specific characters. The bulbous base of the stem is a prominent and peculiar character, tapering gradually into the stem above and having an abrupt short radicle point below.

***Pholiota spectabilis* Fr.**

ORANGE PHOLIOTA. SHOWY PHOLIOTA

Pileus fleshy, compact, convex becoming nearly plane, dry, the cuticle rupturing and forming silky or fibrillose scales, yellow or tawny orange, flesh pale yellow, taste bitter; lamellae close, narrow, adnate or slightly decurrent, yellow becoming ferruginous; stem ventricose or slightly thickened downward, solid, slightly radicating, peronate, mealy above the annulus, fibrillose toward the base; spores elliptic, .0008-.0009 of an inch long, .0002-.00024 broad.

Pileus 2-4 inches broad; stem 2-4 inches long, 6-10 lines thick.

Single or cespitose. Decaying wood and stumps. Queens county. Very rare.

***Pholiota curvipes* Fr.**

CURVE STEM PHOLIOTA

Pileus fleshy but thin, convex becoming nearly plane, obtuse, dry squamulose with minute appressed floccose scales, tawny yellow; lamellae thin, close, adnate, yellow becoming tawny; stem equal or rarely thickened at the base, slender, commonly curved, stuffed or hollow, fibrillose with a slight radiately floccose annulus, yellow; spores naviculoid, .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 10-18 lines broad; stem about 1 inch long, 1-2 lines thick.

Decaying wood. Adirondack region and Oneida county. July to September.

Our specimens vary in the color of the stem, it being in some cases ferruginous toward the base. The spores also are a little larger than the dimensions given in *Sylloge*, but the general agreement with the characters of the species is so good that it does not seem best to separate our plant.

***Pholiota luteofolia* Pk.**

YELLOW GILLED PHOLIOTA

Pileus fleshy, firm, convex, dry, squamulose, fibrillose on the margin, pale red or yellowish; lamellae broad, subdistant, sinuate, serrate on the edge, yellow becoming bright ferruginous; stem firm, fibrillose, solid, often curved from its place of growth, annulus slight, fugacious; spores bright ferruginous, .00028 of an inch long, .00016 broad.

Pileus 1-2 inches broad; stem 1-2.5 inches long, 3-5 lines thick.

Subcespitose. Dead trunks of birch trees, *Betula lutea* Mx. Sullivan county. September. The reddish color of the pileus often fades with age. The species is rare and has not been collected recently. In some of its characters it shows a close relationship to *Pholiota tuberculosa* Fr. from which it may be separated by the absence of a bulbous base to the stem.

***Pholiota lutea* Pk.**

YELLOW PHOLIOTA

Pileus fleshy, firm, convex, dry, slightly silky and sometimes minutely floccose squamulose in the center, buff yellow, often a little darker in the center, the thin incurved margin slightly surpassing the lamellae, flesh pale yellow, odor pleasant, taste bitter; lamellae thin, close, rounded behind, adnexed, pale yellow becoming dark ferruginous; stem firm, solid, thickened at the base, fibrillose, colored like the pileus, the annulus superior, slight, fugacious; spores ferruginous, .0003 of an inch long, .0002 broad.

Pileus 2-4 inches broad; stem 2-3 inches long, 3-5 lines thick.

Decaying wood and trunks of trees in woods. Essex county. August.

Pileus hygrophanus

***Pholiota cerasina* Pk.**

CHERRY PHOLIOTA

Pileus fleshy, firm, broadly convex, glabrous, hygrophanous, cinnamon color when moist, yellow when dry, odor amygdaline, flesh yellow; lamellae close, sinuate, yellow becoming cinnamon or ferruginous; stem equal, solid, sometimes curved, furfuraceous above the annulus, which is slight and fugacious; spores elliptic, minutely rough, .0003 of an inch long, .0002 broad.

Pileus 2-4 inches broad; stem 2-4 inches long, 2-4 lines thick.

Commonly cespitose. Old prostrate trunks of trees in woods. Cayuga county. August.

A rare species. The amygdaline or cherry odor suggests the specific name.

***Pholiota acericola* Pk.**

MAPLE PHOLIOTA

Pileus fleshy but thin, broadly convex or nearly plane, glabrous, often rugosely reticulate or corrugated, hygrophanous, yellow or

sometimes smoky yellow with the center or umbo brownish; lamellae close, sinuate, commonly longitudinally wrinkled when dry, grayish becoming brownish ferruginous; stem equal or thickened at the base, hollow, fibrillose striate, white or whitish with a large membranous, persistent, deflexed, white annulus; spores elliptic, .00035 of an inch long, .00024 broad.

Pileus 1-3 inches broad; stem 2-4 inches long, 3-5 lines thick.

Mossy trunks of maple trees in woods. Essex, Lewis, Otsego and Schoharie counties. July to September.

This species may be easily recognized by its well developed annulus, its rugosely reticulate or pitted pileus and the rugosely wrinkled lamellae of the dried plant. The reticulations of the surface of the pileus usually disappear in drying. When growing in much decayed wood white strings of mycelium develop in the wood.

***Pholiota discolor* Pk.**

FADING PHOLIOTA

Pileus thin, convex becoming nearly plane or slightly depressed, glabrous, viscid, hygrophanous, cinnamon rufous and striatulate on the margin when moist, bright ochraceous yellow when dry; lamellae narrow, close, pallid or whitish becoming ferruginous; stem equal, hollow, fibrillose, whitish or pallid, sometimes with a white mycelioid tomentum at the base, the annulus distinct, persistent; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 8-16 lines broad; stem 1.5-3 inches long, about 1 line thick.

Single or caespitose. Decaying wood and prostrate trunks of trees in woods. Not rare. July to October.

The change of color from the moist to the dry state is well marked. The color of the pileus is similar to that of the next following species but the viscid pileus separates it. *Pholiota discolor caespitosa* Pk. is a mere form, unworthy of being considered a variety.

***Pholiota autumnalis* Pk.**

AUTUMN PHOLIOTA

Agaricus (Naucoria) autumnalis Pk. State Cab. Rep't 23. p. 92.

Pileus fleshy but thin, convex, hygrophanous, cinnamon rufous and striatulate on the margin when moist, dingy yellow when dry;

lamellae thin, close, slightly sinuate, adnate or slightly decurrent, yellowish becoming subferruginous; stem slender, equal, hollow, fibrillose, colored like but paler than the pileus or sometimes brownish toward the base; spores .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 6-16 lines broad; stem 1-2 inches long, 1-2 lines thick.

Single or cespitose. Decaying wood in woods. Albany, Rensselaer and Essex counties. September to November. The annulus is sometimes but slightly developed, and such specimens are liable to be mistakenly referred to the genus *Naucoria*.

***Pholiota confragosa* Fr.**

ROUGH PHOLIOTA

Pileus fleshy but thin; convex becoming nearly plane, fragile, obtuse, floccose squamulose becoming naked, hygrophanous, cinnamon rufous and striate on the margin when moist, tawny when dry; lamellae thin, close, adnate, very narrow, rufous; stem equal, hollow, fibrillose below the spreading membranous annulus, striate above, pallid or pale ferruginous; spores .00028-.0003 of an inch long, .0002-.00024 broad.

Pileus 1-2 inches broad; stem 1-2.5 inches long, 2-3 lines thick.

Single or cespitose. Decaying wood and prostrate mossy trunks in woods. Adirondack mountains. September.

The scales of the pileus are generally so minute that they are easily overlooked. The whole plant is nearly of one color. It is quite fragile and should be handled carefully. The dimensions of the spores are taken from the American plant, as the publications of the European authors do not agree in respect to this character.

***Pholiota marginella* Pk.**

SLIGHTLY MARGINED PHOLIOTA

Pileus fleshy, convex becoming nearly plane, glabrous, hygrophanous, yellowish red or subferruginous and usually striatulate on the margin when young or moist, whitish or yellowish buff when dry, the young margin slightly silky with whitish fibrils; lamellae thin, close, adnexed, minutely eroded on the edge, whitish becoming dark ferruginous; stem equal or nearly so, flexuous, fibrillose below the slight fugacious annulus, mealy or pruinose above, stuffed or hollow, whitish or pallid, sometimes with a white mycelioid tomentum at

the base; spores elliptic, .00024-.0003 of an inch long, .00016-.0002 broad.

Pileus 1-2 inches broad; stem 2-4 inches long, 2-4 lines thick.

Single or caespitose. Decaying wood. Essex county. June. Found but once. The species is apparently related to *Pholiota marginata* (Batsch) from which it may be distinguished by its even fibrillose margin, adnexed lamellae and paler uniformly colored stem. In drying, the moisture, as usual in hygrophaneous species, first disappears from the center of the pileus.

LATIN DESCRIPTIONS OF NEW SPECIES OF PLANTS

Crataegus verrucalis

Frutex vel arbor parva, 2-4 m alta, trunci diametro 2.5-5 cm; ramis longis, tenuibus, divergentibus, erectisve, trunci ramorumque magnorum cortice verrucoso, spinis leviter curvatis rectisve, castaneis, nitidis, 2.5-4 cm long.

Folia ovata vel subovata, acuta acuminatae, basi rotundata vel cuneata, pullulanti tincta fusco-rubro et superiore pubescentia, matura flava-viridia, nitida, glabra, 4-4.5 cm long. 2.5-3 cm lat., in ramis robustis late ovata vel suborbiculata, basi rotundata.

Flores 4-10 in quoque corymbo, 1.2-1.4 cm lat. pediculis leviter villosis, calycis lobis extus glabris, intus hirtellis, staminibus 5-10, antheris rubris, stylis 2-4, plerumque 3.

Poma subglobosa ovalia, 1-1.2 cm long. 8-10 mm lat., vivida rubra, persistentiora, seminibus plerumque 3, 6.5-7 mm long. 3.5-4 lat.

In locis montanis.

Clitocybe subcyathiformis

Pileo carnoso, tenui, late convexo, demum subplano vel centro depresso, glabro, hygrophano, madido albido striatuloque margine, sicco albo vel centro leviter flavido, carne alba, sapore miti; lamellis tenuibus, subconfertis, adnato-decurrentibus, albidis; stipite subaequale, farcto, fibrilloso-reticulato, albido, saepe basi albo tomentoso; sporis ellipsoideis, 6-8 x 4-5 μ .

Pileus 2.5-5 cm lat.; stipes 2.5-4 cm long., 4-8 mm. lat.

In locis humidis sub alnis betulisque.

Hygrophorus coloratus

Pileo carnosio, convexo subplanove, saepe umbonato, levi, viscoso, luteo, aurantiaco vel cinnabarino, carne alba, sub pellicula flava; lamellis inaequalibus, distantibus, arcuatis, adnato-decurrentibus, albis flavescentibusve; stipite aequale, subinde deorsum incrassato, glutinoso, farcto cavove, albo vel leviter flavo, in juventute subinde velo floccoso ad apicem; sporis $8-10 \times 5-6 \mu$.

Pileus 2.5-6.5 cm lat.; stipes 5-7.5 cm long., 4-8 mm lat.

In locis humidis sub arboribus laricinis abietinisque.

Clitopilus subplanus

Pileo tenui, late convexo, demum subplano, centro leviter depresso aut distincte umbilicato, glabro, albido, carne alba; lamellis tenuibus, confertis, adnato-decurrentibus, sordide incarnatis; stipite tenui, glabro, tereti compressove, farcto, demum cavo, albido; sporis incarnatis, angulosis, uninucleatis, $10-12 \times 6-8 \mu$.

Pileus 2.5-4 cm lat.; stipes 2.5-4 cm long., 2-4 mm lat.

Inter folia putrescentia in silvis.

Nolanea suaveolens

Pileo submembrano, convexo, umbilicato, obscure fibrilloso im-politove, margine indistincte striato, fumoso; lamellis tenuibus, inaequalibus, confertis, adnatis, albidis, demum sordide rosaceis; stipite tenue, glabro, cavo, fusco; sporis angulosis, uninucleatis, $10-12 \times 6-8 \mu$.

Pileus 1.5-4 cm lat.; stipes 3-5 cm long., 1 mm lat.

In silvis. Specimina exsiccata odorem gratum, *Lactarii glyciosmi* et *L. camphorati* illum simulantem emittunt.

Pholiota duroides

Pileo tenui, convexo, demum subplano, glabro, subinde centro leviter rimoso-squamoso, ex albo ochraceoluteo; carne alba, sapore miti; lamellis tenuibus, confertis, angustis, adnexis, subinde late sinuatis et dente decurrentibus, albidis, demum fusco-ferrugineis; stipite aequale, farcto cavove, glabro, albido, annulo crasso, lanuginoso, saepe lacerato evanescenteque, albo; sporis late ellipticis, $6-8 \times 4-5 \mu$.

Pileus 2.5-5 cm lat.; stipes 2.5-5 cm long., 4-8 mm lat.

In silvis. E *Pholiota dura* (Bolt.) Fr. in colore, carne molliore sporisque minoribus differit. Inter *Pholiotam* et *Strophariam* ambigua.

Flammula pulchrifolia

Pileo carneo, tenui, hemisphaerico, deinde convexo, viscidulo, hygrophano, fibrilloso, subinde centro squamuloso, margine fibrilloso, rosaceo, subinde pallido; carne alba, amara; lamellis tenuibus, confertis, adnatis, subinde leviter sinuatis, albidis, mox nitide luteis vel fulvo-ochraceis; stipite aequale, farcto cavove, pallido, saepe basi flavo, apice fibrilloso e velo; sporis in strato tenui fulvo-ochraceis, in strato crasso ochraceo-luteis, $7.5-8 \times 5-6 \mu$.

Pileus 2.5-5 cm lat.; stipes 2.5-4 cm long., 3-4 mm lat.

Ad lignum *Tsugae canadensis* Carr.

Clavaria ornatipes

Gregaria, 2.5-5 cm alta, sparse ramosa; stipite gracile, hirsuto, fusco; ramulis paucis, irregularibus, teretibus, albidis griseis vel cinereis, acutis obtusisve; sporis late ellipticis vel subglobosis, $8-11 \times 6-8 \mu$.

Inter muscos in locis humidis silvarum.

Clavaria trichopus Pers. *New York State Museum Report* 24, page 82. Noster fungus est distinctus in colore, habitate paucitateque ramorum.

Myxosporium necans

Acervuli in lineis longis sub epidermide nidulantes, erumpentes, intus albidii; conidiis oblongo-ellipticis in massas albas cirrosve flavido-albos expulsis, saepe binucleatis, $6-10 \times 2-3 \mu$.

In cortice *Pruni virginianae* L. vivae. Fungus fruticem mox necat.

EXPLANATION OF PLATES

PLATE IIO

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Clitocybe subcyathiformis Pk.

SAUCER CLITOCYBE

- 1 Immature plant with moist pileus
- 2 Immature plant with dry pileus
- 3 Mature plant with center of pileus slightly colored
- 4 Two mature plants united at the base
- 5 Vertical section of the upper part of a mature plant
- 6 Four spores, x 400

Russula pusilla Pk.

SMALL RUSSULA

- 7, 8 Two immature plants showing the upper surface of the pileus
- 9, 10 Two larger immature plants showing color of the lamellae
- 11 Large mature plant showing color of the lamellae
- 12 Vertical section of an immature plant
- 13 Vertical section of a mature plant
- 14 Four spores, x 400

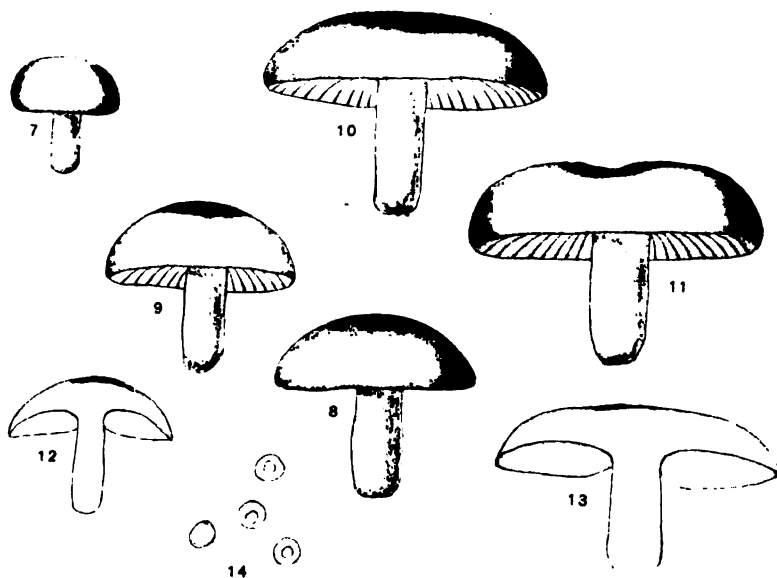
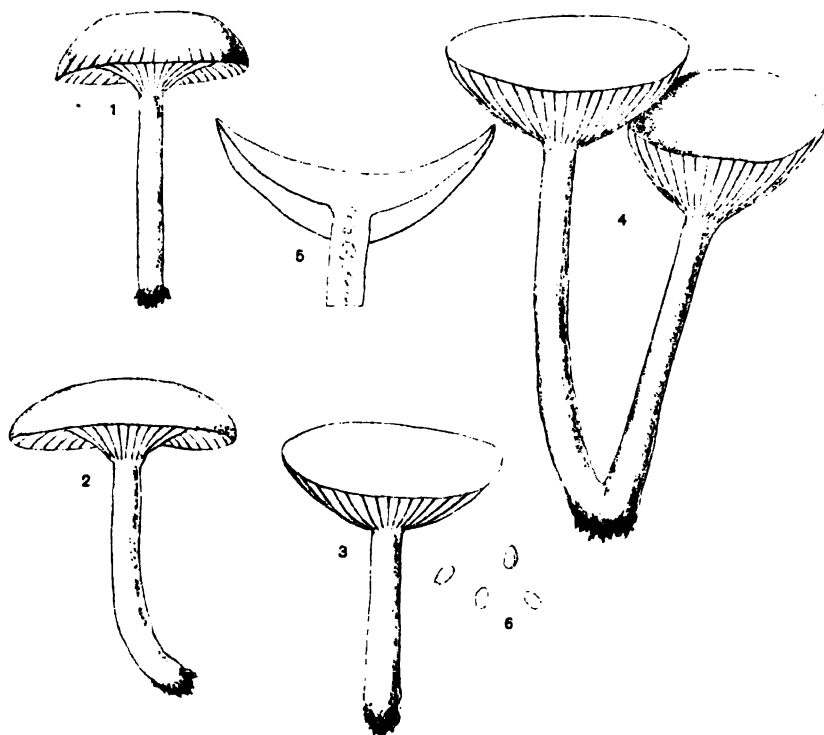


FIG. 1-6.
CLITOCYBE SUBCYATHIFORMIS Pk.
SAUCER CLITOCYBE

FIG. 7-14.
RUSSULA PUSILLA Pk.
SMALL RUSSULA

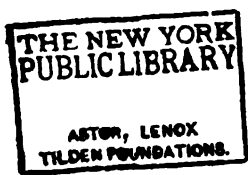


PLATE III

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***Collybia dryophila* (Bull.) Fr.**

OAK LOVING COLLYBIA

- 1 Immature plant
- 2 Cluster of three plants, two of them immature
- 3, 4 Two plants with the pileus more highly colored
- 5 Mature plant with the pileus fully expanded
- 6 Immature plant with pileus highly colored and stem bulbous
- 7 Mature plant with pileus highly colored and stem bulbous
- 8 Vertical section of the upper part of an immature plant
- 9 Vertical section of the upper part of a mature plant with expanded pileus
- 10 Transverse section of a stem
- 11 Four spores, x 400



COLLYBIA DRYOPHILA (BULL.) FR.
OAK LOVING COLLYBIA

Crepidotus malachus B. & C.

SOFT SKINNED CREPIDOTUS

- 1 Mature plant showing the upper surface of the pileus
- 2 Mature plant showing the lower surface of the pileus
- 3 Vertical section of a mature plant
- 4 Four spores, x 400

Stropharia bilamellata Pk.

DOUBLE GILLED STROPHARIA

- 5 Immature plant with pileus convex
- 6 Mature plant with pileus expanded
- 7 Vertical section of the upper part of an immature plant
- 8 Vertical section of the upper part of a mature plant
- 9 Transverse section of a stem
- 10 Four spores, x 400

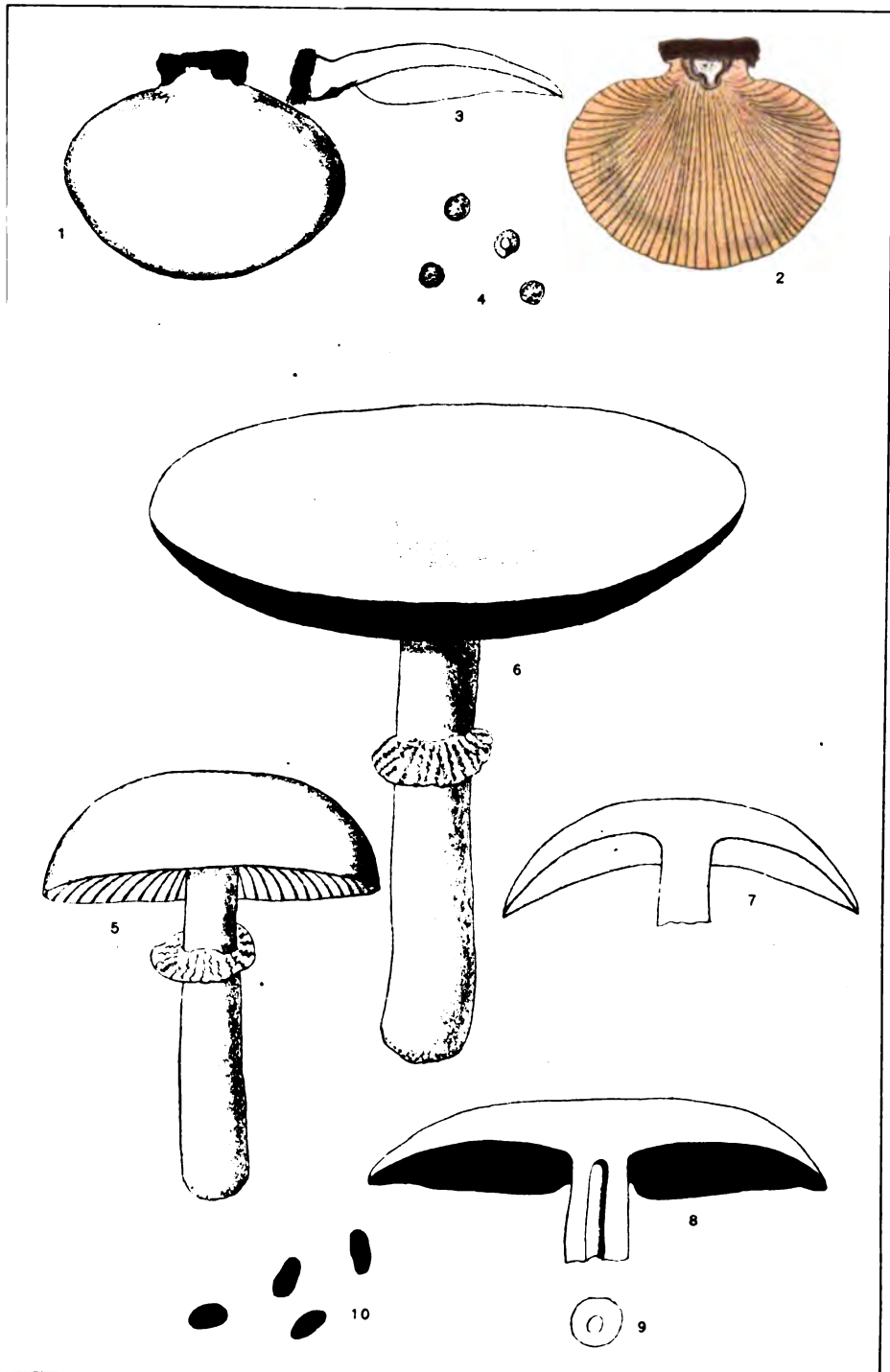


FIG. 1-4.
CREPIDOTUS MALACHIUS B. & C.
SOFT SKINNED CREPIDOTUS

FIG. 5-10.
STROPHARIA BILAMELLATA PK.
DOUBLE GILLED STROPHARIA

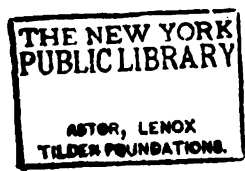


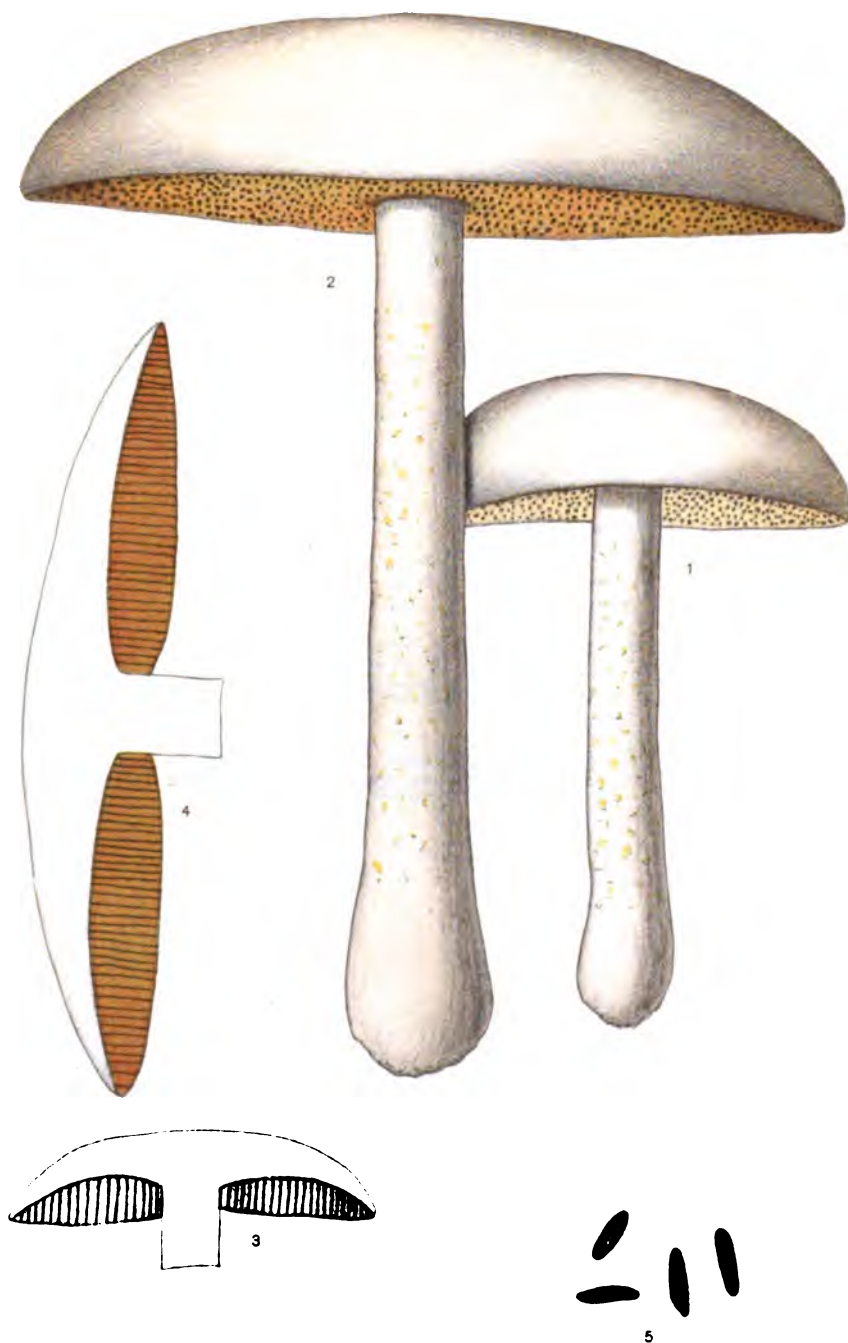
PLATE 113

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Boletus niveus Fr.

SNOWY BOLETUS

- 1** Immature plant
- 2** Mature plant
- 3** Vertical section of the upper part of an immature plant
- 4** Vertical section of the upper part of a mature plant
- 5** Four spores, x 400



BOLETUS NIVEUS Fr.
SNOWY BOLETUS

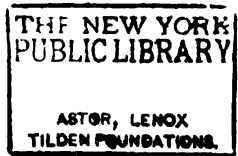


PLATE I14

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***Lycoperdon subincarnatum* Pk.**

PINKISH PUFFBALL

- 1 Cluster of three plants
- 2 Plant darker colored
- 3 Mature plant showing pitted peridium
- 4 Vertical section of an immature plant
- 5 Vertical section of a mature plant
- 6 Four spores, x 400

***Lycoperdon gemmatum* Batsch**

STUDDED PUFFBALL

- 7 Immature plant of usual size and shape
- 8 Immature plant showing an umbo
- 9 Sessile plant showing reticulated surface from which the larger warts have fallen
- 10 Long stemmed plant showing plicate base of peridium and upper part of stem, also reticulated place from which the larger warts have fallen
- 11 Long stemmed plant with larger warts closely placed and upper part of stem coarsely pitted
- 12 Vertical section of a small immature plant
- 13 Vertical section of a mature plant with stem tapering downward
- 14 An old denuded discolored plant
- 15 Four spores, x 400

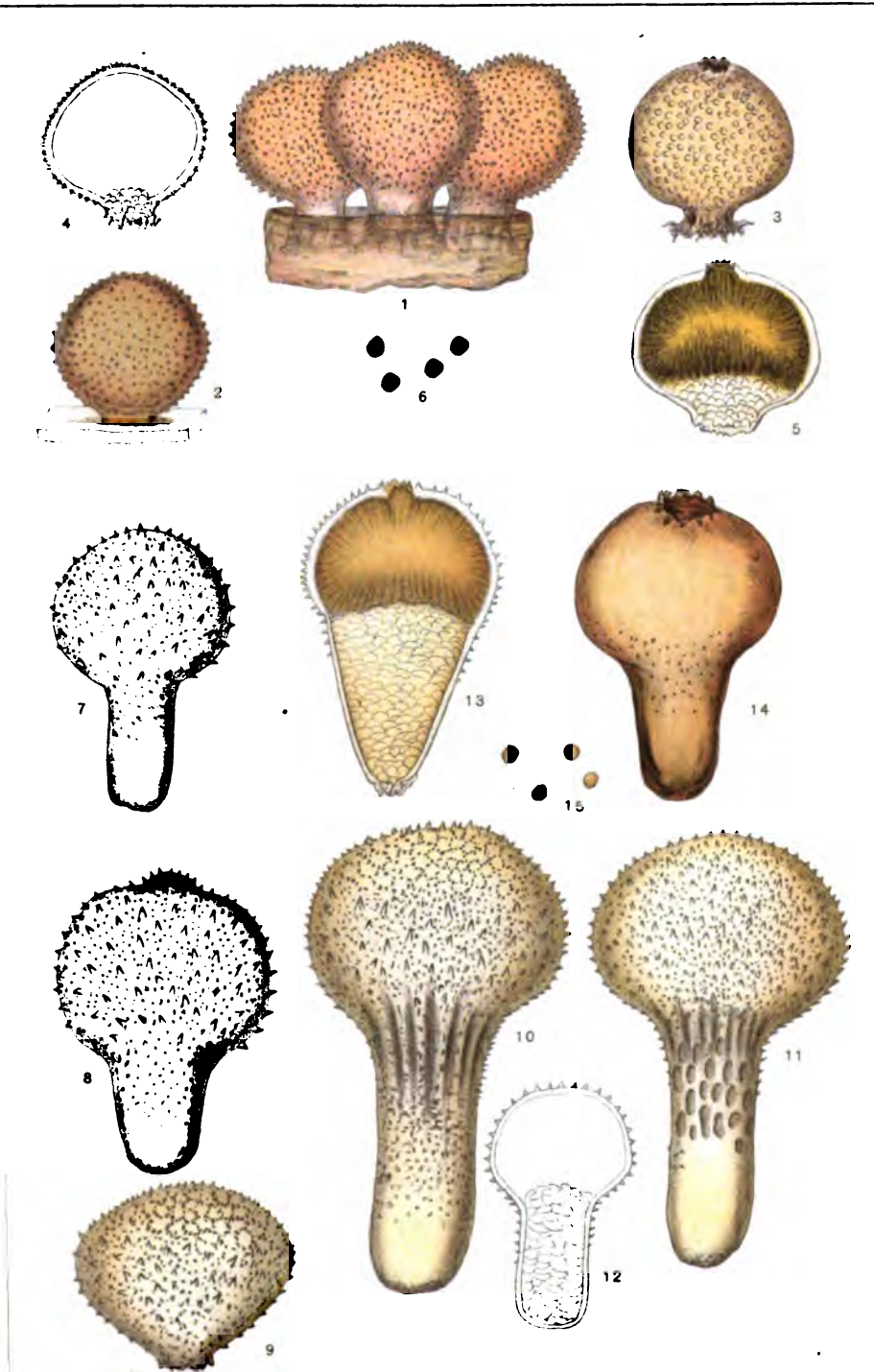
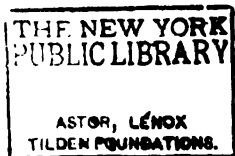


FIG. 1-6.
LYCOPERDON SUBINCARNATUM Pk.
PINKISH PUFF BALL

FIG. 7-15.
LYCOPERDON GEMMATUM BATSCH
STUDDER PUFF BALL.



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v. 5 pt5 Mollusca. 4+271p. 40pl. pt6 Crustacea. 70p. 13pl. 1843-44.
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- & Clarke, John M. v. 8 pt₁ Introduction to the Study of the Genera of the Paleozoic Brachiopoda. 16 + 367p. 44pl. 1892. \$2.50.
- & Clarke, John M. v. 8 pt₂ Paleozoic Brachiopoda. 16 + 394p. 64pl. 1894. \$2.50.
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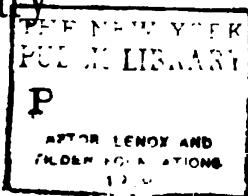
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A SELECTION FROM THE

BEST BOOKS OF 1907

WITH NOTES



PREFATORY NOTE

To the Librarian:

This is an annotated list of 250 books published in 1907, selected by the book board of the New York State Library and recommended to the public libraries of the State. To aid in choosing small collections of new books three classes are indicated: books marked *a*, of which there are 20, are suggested to libraries which must confine their additions within narrow limits; 30 others marked *b* are also proposed to libraries that can buy 50 books; and 50 marked *c* may be added to *a* and *b* to make up 100 books. The remaining 150, including some reference books and a few more costly publications, are worthy careful consideration by libraries that can buy more than 100 books and by those wishing to enlarge resources in special subjects. Many of the unmarked works are of the highest merit.

It is of course impossible for any board to determine which 100 or 200 books are absolutely the best; still less could it make a selection which would fit the needs of every small library in the State. Books marked *c* may be *a* in value in certain cases. The best general advice may, and sometimes should, be rejected in view of actual needs, and the librarian should of course be better able to determine such needs than a distant board of advisers. It is thought best to inform the smaller libraries about some books which would be of high practical value to them, though probably too expensive to be bought from the ordinary fund. Special circumstances may sometimes justify buying such a work at the sacrifice of several cheaper ones. Occasionally, too, some gener-

ous friend or local club expresses a wish to make a town library a substantial gift. If the librarian can make prompt and definite suggestions it is an advantage to the community and the satisfaction of the benefactor is materially increased.

We can not too strongly emphasize the advice which we have for several years quoted in full from the *Journal of New Jersey Libraries*, October 1903: Do not buy subscription books; avoid books issued in parts; ask advice before purchasing expensive reprints.

Finest Orations, Noblest Essays, Royal Flim Flams, Huge Anthologies, and the like all come to the secondhand man. Get them of him, if you must. In a small library they are generally almost useless. In subscription books, cases like this are not uncommon. Maspero wrote several large and learned volumes, in French, on Egypt and Chaldea. They were translated and published in three or four volumes in England, costing libraries in this country about \$5 each. An American publisher reprints them in 12 small volumes with a few additional colored cuts, on heavier paper and in larger type and offers them through agents for \$84—and libraries buy them!

Do not buy "sets" or complete editions of authors. Buy the volumes you need and as you need them. A complete set always includes several volumes you do not need. Specify the edition you wish of standard books when you can, unless you find a bookseller able and willing to select them wisely for you.

While this list has been prepared with special reference to smaller public libraries it will also be of much service to schools. Not all the books listed, however, are recommended for school use. There are some books in fiction which have not enough positive value either as literature or as a spur to historical study, to justify their purchase for a school, yet which serve a legitimate purpose in the public library by providing wholesome entertainment for a very different class of readers. All titles under the heading "Juvenile" are recommended for those school libraries which undertake to provide wholesome entertainment as well as useful information.

This list, like its predecessors since 1897, has been prepared under the general direction of Martha T. Wheeler of the State Library staff.

J. I. WYER, JR
Director

Albany, July 30, 1908

CLASSIFIED LIST

The source of a critical note is indicated, if taken from a review, whether quoted exactly or slightly condensed. Additional references are given to the best reviews.

Decimal classification numbers, as used in the State Library, and Library of Congress printed catalogue card serial numbers are added, in the left margin, for convenience of libraries using them.

Abbreviations: n is used for net and the sign / for shillings; e. g. 12/6 means 12s 6d.

REFERENCE BOOKS

- 282** **Catholic encyclopedia:** an international work of reference on the constitution, doctrine, discipline and history of the Catholic church. 15 v. v. 1-2.
Robert Appleton \$6 ea.
- 7-11606 An American enterprise with many foreign contributors. Scope broader than title indicates, including articles on countries ancient and modern, biographies of Catholics of all times prominent in history, literature, art or science, Biblical topics and characters and many general subjects, as Agrarianism, Alexandrian library, Anarchy, Astrology, Baptists, Bells, Brehon laws, etc. Articles are popular, signed and followed by bibliographies. Paper highly glazed. Half-tone and colored plates, text illustrations, facsimiles and maps.
Nation, 84:566.
- 603** **c Hiscox, G. D. ed.** Henley's twentieth century book of recipes, formulas and processes. Henley \$3
- 7-8246 Primarily intended to meet practical requirements of mechanics, manufacturers, artisans and housewives. Nearly 10,000 headings, ranging from Adhesives, through Alloys, Cheese, Cleaning preparations, Dentrifices, Inks, Lubricants, Photographic processes, Solders, Water proofing, etc.
Engin. News, 57:308.
- 630.3** **Bailey, L. H. ed.** Cyclopedia of American agriculture. 4 v. v. 1, Farms; v. 2, Crops. Macmillan \$5 n ea.
- 7-8529 Grouped by subjects so as to form a comprehensive treatise, the composite work of several hundred specialists. v. 1, a survey of the agricultural features of the United States and its dependencies, the planning, machinery, buildings, etc. of a farm, soil and its treatment, weather service and conditions. v. 2, the structure and breeding of plants, crop management, etc., the preserving industries, manufacture of wines, alcohol and other liquors and a detailed account of each field crop. Numerous text illustrations and plates. A full index to each volume.
Nation, 85:380 (v. 1, 2); Nature, 76:315 (v. 1); N. Y. Times Sat. R. 12:307 (v. 1), 12:720 (v. 2).
- 808.8** **c Benham, W. G. comp.** Book of quotations, proverbs and household words.
(Cassell 10/6 n) Lippincott \$3
- W7-116 Comprises quotations from English and American literature, arranged alphabetically by authors (410 p.), followed by Bible, Prayer book and miscellaneous (55 p.), Greek and Latin (246 p.),

modern European languages in original and translation (26' p.), Proverbs (150 p.) and full word index (356 p.). A valuable supplement to Bartlett's *Familiar quotations*, embracing much material not readily found elsewhere.

Ath. 1907, 1:22; Dial, 43:32; Nation, 85:397; Spec. 98:297.

BIBLIOGRAPHY AND READING

- 016.823 **Baker, E. A.** History in fiction: a guide to the best historical romances, sagas, novels and tales. 2 v. (English lib.) Dutton \$1.50 n

7-29857 v. 1, fiction relating to England and her colonies; v. 2, fiction relating to America and foreign lands. Arranged by period. English and American publisher, price, date of publication, period covered, brief characterization. "Historical" used in broad sense, to include life of past. Books for children marked *juv.* Author, title and subject index for each volume.

Bookman, 26:82; Outlook, 86:792; Spec. 99:27.

- 028.5 **Carnegie Library, Pittsburgh.** Story hour courses for children, from Greek myths; the Iliad and the Odyssey. Carnegie Library 5c

6-45363 Consists of references to various versions of 20 stories told to older children and 27 told to younger children, with list of volumes referred to.

- 028.5 **Field, W. T.** Fingerposts to children's reading. McClurg \$1 n

7-11093 Papers on home and school reading, school, public and Sunday school libraries, the illustration of children's books, Mother Goose, etc. Practical and definite in suggestions. While one may take issue with some of his dicta and selections, the book is suggestive and in the main sensible.

Dial, 42:228; Outlook, 86:140.

- 028.5 **Salisbury, G. E. & Beckwith, M. E.** Index to short stories: an aid to the teacher of children. Row 50c

7-17900 Alphabetico-classed arrangement, under such headings as Amber, Apples, Bees, Behavior, Charity, Chickens, etc. Books referred to, with publishers and prices, listed at end.

PHILOSOPHY

- 149.9 **James, William.** Pragmatism: a new name for some old ways of thinking; popular lectures on philosophy. Longmans \$1.25 n

7-20643 Unconventional and picturesque presentation of a philosophy for the average man, which tests the validity of every theory by the way it works out in actual practice. Lowell lectures.

. Acad. 73:772; Atlantic, 101:657; Bookman, 26:215; Nation, 85:57; Philos. R. 16:624; Science, 49:464; Spec. 99:9.

ETHICS

See also Juvenile, p. 41.

- 170 c **Hadley, A. T.** Standards of public morality: Kennedy lectures for 1906. (Amer. soc. progress ser.)
Macmillan \$1 n
- 7-21398 Five addresses by the president of Yale, on The formation of public opinion; The ethics of trade; The ethics of corporate management; The workings of our political machinery; The political duties of the citizen.
- 7-20888 *True and false democracy* by President Butler of Columbia (Macmillan \$1 n 321.8) consists of three addresses on democracy and education, the value of knowledge in politics and the necessity for a cultivation of public sentiment among educated men.
Wilmington.
Hadley, Atlantic, 101:373; Annals of Amer. Acad. 31:223; Dial, 43:123. Butler, Atlantic, 101:373; Dial, 43:43; Nation, 85:229.
- 172.1 a **Root, Elihu.** The citizen's part in government. (Yale lectures on the responsibilities of citizenship)
Scribner \$1 n
- 7-227CO Shows that individual self-control and public honesty are the basis of popular government under modern complex conditions; that party organization is necessary; that citizens are personally responsible for prevention of boss rule; also reviews grounds for encouragement.
Atlantic, 101:373.
- 174.4 c **Ross, E. A.** Sin and society: an analysis of latter-day iniquity.
Houghton \$1 n
- 7-36978 Vigorous papers emphasizing the enormity of crimes against society and endeavoring to crystallize public sentiment against the grafter, briber and corrupt monopolist. Appeared in the *Atlantic*.
Amer. Jour. of Sociol. 13:566; Annals of Amer. Acad. 31:295.

RELIGION

- 215 **Lodge, Sir O. J.** The substance of faith allied with science: a catechism for parents and teachers.
Harper \$1 n
- 7-9613 Twenty questions and answers with a short chapter of comment on each, leading those shaken in faith by recent controversies to firm ground where religion and science can consistently meet.
Dial, 42:341; Sat. R. 104:276; Spec. 98:946.
- 252 **Peabody, F. G.** Mornings in the College Chapel.
2d ser. Houghton \$1.25 n
- 7-37984 A few plain words added to morning prayers on the problems of life and faith with which young men find themselves confronted.
Preface.
By the professor of Christian morals and former preacher at Harvard University. First series was entitled *Afternoons in the College Chapel*.

- 261** **Jenks, J. W.** Political and social significance of the life and teachings of Jesus.
Internat. Com. of Y. M. C. A. 75c
- 6-46236 A manual for study. About a series of 12 topics Professor Jenks groups references for reading, suggestive quotations and stimulating comment. *Biblical World*, 29:160.
Outlook, 85:281.
- 261** **a Mathews, Shailer.** The church and the changing order.
Macmillan \$1.50 n
- 7-18117 An appeal to the church to adjust its relation to modern scholarship, social discontent, the social movement, materialism, etc. Broadminded yet conservative.
- 7-13925 Rausenbusch's *Christianity and the social crisis* (Macmillan \$1.50 n) traces the relations of Christianity to society, beginning with the political activities of the Hebrew prophets. Maintains that the Christian church in its "other-worldliness" has lost sight of its primary purpose, the immediate regeneration of society, and suggests measures for fraternal reorganization of social life.
Mathews, Nation, 85:145. Rausenbusch, Dial, 43:249; Nation, 85:39; N. Y. Times Sat. R. 12:345.
- 263.6** **c Faris, J. T. comp.** Pleasant Sunday afternoons for the children: a book for parents.
Sunday Sch. Times 50c n
- 7-32352 Suggests to parents a variety of simple occupations and diversions designed to make Sunday an attractive and profitable day in the home.
- 266** **b Brown, A. J.** The foreign missionary. Revell \$1.50 n
- 7-23292 Presents in readable form much useful information on qualifications, motives, appointment, financial support, relations with appointing board, methods, critics, difficulties, spirit, rewards, etc.
Nation, 85:303; N. Y. Times Sat. R. 12:746.
- 270.1** **Gilbert, G. H.** Short history of Christianity in the apostolic age.
Univ. of Chic. \$1
- 6-41055 Narrative, commentary, questions and suggestions for study, with supplementary topics and references to literature. A manual for college, academy or advanced Sunday school classes, practically extending the course begun in Burton & Mathews's *Constructive studies in the life of Christ* (Univ. of Chic. 1901) which is based on the Gospels. Illustrated.
Biblical World, 28:432; Outlook, 85:141.
- 289.9** **Powell, L. P.** Christian science: the faith and its founder.
Putnam \$1.25 n
- 7-40519 Outcome of painstaking investigation by an Episcopal clergyman who for some years viewed Christian science with friendliness, but here states clearly his reasons for rejecting it.
Educ. R. 35:206; Outlook, 88:565.
- 296** **Gregg, David.** Between the Testaments: or, Inter-biblical history.
Funk 75c n
- 7-12267 Brief, popular sketch of period of Jewish history treated in the books of the Apocrypha, with critical and descriptive comments on the books themselves.

SOCIOLOGY

- 325.73 b Commons, J. R.** Races and immigrants in America. Macmillan \$1.50 n
- 7-17894 Discusses the assimilation of the various elements contributing to our population, in connection with problems of industry, labor unions, city life, crime, health, politics. Advocates increased restriction of immigration. *The immigrant Jew of America*, issued by the Liberal Immigration League (Buck \$1.50), studies by five authorities of the Jews of New York, Philadelphia and Chicago, covers education, religious and social life and economic conditions. Advocates wider distribution.
- 7-424 Commons, *Annals of Amer. Acad.* 31:217; *Dial*, 43:122; *Nation*, 85:229; *Putnam's*, 2:742.
- 331.8 More, Mrs L. B.** Wage-earners' budgets. (Greenwich House ser. of soc. stud.) Holt \$2.50 n
- 7-30623 Detailed and sympathetic study of standard and cost of living of typical New York city wage earners above the dependent class. Estimates a "fair living wage" for a family of five as \$728 a year. *Annals of Amer. Acad.* 31:228; *Jour. of Polit. Econ.* 15:560; *Nation*, 86:283; *Spec.* 100:506.
- 335 Mallock, W. H.** Critical examination of socialism. Harper \$2 n
- 7-39227 Attacks the fallacies of socialistic theory, chief of which is the belief that a society could exist which excludes competition but is able to supply incentive to men of exceptional ability to produce wealth for society at large. In controversial form, based on addresses delivered in America, on invitation of the National Civic Federation, and embodying answers to his critics. The original lectures are printed by the federation under the title *Socialism* and distributed free. Prof. Goldwin Smith's *Labor and capital* (Macmillan 50c 331) condemns the excesses of new trade unionism and criticizes the proposals of socialism from the standpoint of a historian. Spargo's *Capitalist and laborer* (Kerr 50c n 331) is an open letter criticizing temperately Professor Smith's statements, and defending the socialist movement. This small volume contains also *Modern socialism*, a lecture delivered at the New York School of Philanthropy, summing up "Marxism" and answering points in Mallock's lectures. Le Rossignol's *Orthodox socialism* (Crowell \$1 n) is a brief exposition and destructive criticism of Marxian or "scientific" socialism, rejecting revolution but accepting the need of social evolution.
- 7-7165 Mallock, *Acad.* 72:759; *Ath.* 1908, 1:191; *Dial*, 44:39; *Nation*, 86:491; *Sat. R.* 105:303.
- 7-23082 Smith, *Annals of Amer. Acad.* 29:647; *Dial*, 42:287.
- 7-12999 Spargo, *Amer. Jour. of Soc.* 13:372; *Independent*, 63:370.
- Le Rossignol, *Annals of Amer. Acad.* 30:596; *Dial*, 43:69.
- 340.8 c Hill, F. T.** Decisive battles of the law; narrative studies of eight legal contests affecting the history of the United States. Harper \$2.25 n
- 7-33964 U. S. *vs* Callender, a fight for freedom of the press; Burr conspiracy; John Brown raid; Dred Scott trial; impeachment of President Johnson; Alabama arbitration; Hayes-Tilden controversy; Chicago anarchists' trial. Accounts combine technical and historical accuracy with the novelist's dramatic gift.
- Bookman, 26:519; *Dial*, 44:19; *Nation*, 86:103.

- 352** *b* **Addams, Jane.** Newer ideals of peace. (Citizens' lib. of econ., pol. and sociol.) Macmillan \$1.25 n
- 7-4377 Stimulating discussion of industrial and political conditions in a large American city, contending that the conception of government as a military power is antiquated and that the spirit of aggressiveness should be utilized for social amelioration. Typography far below Macmillan's standard.
Amer. Jour. of Sociol. 13:121; Annals of Amer. Acad. 29:409; Dial, 42:246; Nation, 84:247.
- 353.7** *c* **Mahan, A. T.** From sail to steam: recollections of naval life. Harper \$2.25 n
- 7-32861 Delightful reminiscences of Captain Mahan's naval career (1856-96) involving an informal history of the reconstruction in policy and equipment which our navy has undergone.
Ath. 1908, 1:151; Dial, 43:365; Nation, 85:564; Spec. 99:615.
- 368.3** **Hendrick, B. J.** Story of life insurance. McClure \$1.20 n
- 7-17891 Clear, concise history of life insurance in America, including a discussion of principles and a description of the corrupt practices leading to scandals of 1905-6. Reprinted from *McClure's*. Ten portraits.
Nation, 84:486; Spec. 98:986.
- 385** **Haines, H. S.** Railway corporations as public servants. Macmillan \$1.50 n
- 7-30619 Lectures before Boston University Law School by a practical railroad manager. Discusses development of railroads as public utilities, reviews restrictive legislation since passage of Interstate Commerce Law, and suggests means for betterment of relations between corporations and public. Opposes government ownership.
Dial, 44:130; Nation, 86:108.
- 387** *c* **Buckman, D. L.** Old steamboat days on the Hudson river. Grafton Press \$1.25 n
- 7-36976 Interesting details in the evolution of steam navigation on the Hudson from Fulton's Clermont to the present (1907) finely equipped side wheelers and propellers. Well illustrated.
Dial, 44:42.

EDUCATION

- 374** **Shaw, Albert.** Outlook for the average man. Macmillan \$1.25 n
- 7-39228 Five addresses to college students on the individual's relation to present social, economic and political conditions in the United States. Embodies an optimistic and comfortable philosophy, but sets high standards for business and professional life.
Dial, 44:109; Educ. R. 35:206; Independent, 64:418; Jour. of Polit. Econ. 16:50.
- 377.2** *c* **Du Bois, Patterson.** Culture of justice: a mode of moral education and of social reform. Dodd 75c n
- 7-16993 Popular discussion of principles of justice as applying to family and school life. Chapters on loyalty *vs* slavish obedience, corporal punishment, and money as a means of moral training. Lectures in extension course, Union Theological Seminary.
Outlook, 86:611.

- 377.2** **Moral training in the public schools: the California prize essays.** Ginn \$1.50
 7-28175 The two prize essays and three ranking next.
 A notable contribution to the discussion of moral education and allied problems, and simplicity of treatment makes it easy reading.
 W. S. Monroe, Jour. of Philos. 5:51.
 Deserves attention from parents as well as teachers.
 Nation, 86:399.
 Cath. World, 86:824; Dial, 44:276; Educ. R. 35:103; Elem. Sch. Teacher, 8:463.
- 378.1** **Birdseye, C. F.** Individual training in our colleges. Macmillan \$1.75 n
 7-18833 Elaborate survey and comparison of past and present conditions in American colleges, marking losses and suggesting remedies. Lays special emphasis on student life, personal influence of professors, and possibilities for good through fraternities.
 Dial, 43:285; Educ. R. 34:325; Nation, 85:281.
- 379.73** **Kern, O. J.** Among country schools. Ginn \$1.25
 6-32687 Vigorous plea for improved education in country districts, advocating erection of attractive buildings, school gardens, consolidated schools, classroom decoration, study of practical agriculture, trained teachers, etc. By superintendent of schools, Winnebago county, Illinois. 154 suggestive halftones.
 Nation, 83:516.

CUSTOMS AND FOLKLORE

See also Juvenile, p. 41-42.

- 394** **b Schaffler, R. H. ed.** Christmas: its origin, celebration and significance as related in prose and verse. (Our Amer. holidays) Moffat \$1 n
 7-70006 Sketches, stories, verses and hymns by authors well known and obscure. Useful for school exercises and entertainments and interesting as a collection of Christmas literature. It is to be regretted that exact references to source of extracts are not supplied, and that occasional liberties are taken with text; e. g. in the quotation from Scott's *Marmion*, p. 84. Carelessness in proof-reading is also apparent.
- 7-31450 *Thanksgiving* (Moffat \$1 n), same author and series, is a compilation along similar lines.
- 398.2** **Maynadier, G. H.** The Arthur of the English poets. Houghton \$1.50 n
 7-15547 Likely to supersede MacCallum's *Tennyson's Idylls and the Arthurian story*, which has long done good service as the best popular account of the development of the Arthurian legend in the Middle Ages and its treatment by the English poets. *Nation*, 84:594.
- 7-26418 J. F. Genung's *The idylls and the ages* (Crowell 75c 821.81) is a brief inquiry into the permanent value of Tennyson's epic, which grasps with remarkable completeness his presentation of ideal manhood.
 Maynadier, Dial, 43:20; Sat. R. 104:364; School R. 15:768.
 Genung, Nation, 85:494.

LANGUAGE

- 408.9 Baker, Arthur.** American Esperanto book. Kerr \$1
 7-24462 Thorough, practical handbook for the student, including clear explanation of alphabet and grammar, graded exercises and double vocabulary.

NATURAL SCIENCE

See also Juvenile, p. 42.

- 523 a Martin, M. E.** The friendly stars. Harper \$1.25 n
 7-14831 Popular, entertaining descriptions of the 20 brightest stars and principal constellations. Indicates location, color, distance, movements, rising and setting. Makes identification with naked eye easy, and inspires a sense of companionship with the constant stars. Maps and diagrams.
- 7-26464 W. T. Olcott's *Field book of the stars*** (Putnam \$1 n) is a compact guide, providing 50 clear diagrams which show the principal stars in each important constellation. Brief text gives necessary explanations. Alphabetic table of star names, with meanings.
 Martin, Dial, 42:317; Nature, 76:412. Olcott, N. Y. Times Sat. R. 12:557; School R. 16:346.
- 523.43 Lowell, Percival.** Mars and its canals.
 Macmillan \$2.50 n
- 6-45164** Popular presentation of author's observations of the planet's surface features, his theories in regard to nature and origin of markings and conclusions as to presence of intelligent life. Maps, photographs and charts.
 Ath. 1907, 1:478; Dial, 42:76; Nation, 84:317; Science, 48:499.
- 533.6 Aero Club of America.** Navigating the air: a scientific statement of the progress of aeronautical science up to the present time. Doubleday \$1.50 n
- 7-20981** Short articles by 23 experts, mainly on special problems of flight, with some actual experience in ballooning.
- 8-12141 Marshall and Greenly's *Flying machines, past, present and future*** (Spon & Chamberlain 50c n) is a popular account of flying machines, aeroplanes, dirigible balloons and their principles of construction, with references to sources of technical information. Both illustrated by halftones and diagrams.
 Aero Club, Engin. News, 58:181; N. Y. Times Sat. R. 12:441.
- 537 c Gibson, C. R.** Electricity of today: its work and mysteries described in non-technical language.
 Lippincott \$1.50 n
- W6-342** Popular treatise on application to transportation, illumination, heating and cooking, telegraphy, the telephone, medicine, etc. 24 halftone plates.
 Ath. 1906, 2:776.
- 551.2 b Houston, E. J.** Wonder book of volcanoes and earthquakes. Stokes \$1.50
- 7-36868** Discusses seismic disturbances of all kinds, the nature, action and effects of terrestrial, submarine and lunar volcanoes, and describes historic disasters from Pompeii to San Francisco.

- 7-39003 Hobbs's *Earthquakes* (Appleton \$2 n 551.22) is a popular exposition by a specialist of the more extreme theories of the "new seismology," which involves geological research as well as delicate physical calculations. Bibliographies at end of chapters. Both books have maps, plates and text drawings.
Hobbs, Dial, 44:110; Nation, 86:494; Outlook, 88:41.
- 570 Morley, M. W. The renewal of life; how and when to tell the story to the young. McClurg \$1.25
- 6-34396 For parents, complementing her *Song of life*, addressed to the child. Strongly urges telling the truth, but outlines a plan of gradual attainment of full knowledge through acquaintance with facts of plant and animal life.
Nature Study R. 3:60.
- 575 Jordan, D. S. & Kellogg, V. L. Evolution and animal life. Appleton \$2.50 n
- 7-29033 Elementary discussion of facts, processes and theories relating to organic evolution. Fully illustrated from photographs and drawings. Bibliographic references. For general readers or students of biology.
- 7-29032 Kellogg's *Darwinism today* (Holt \$2 n), for more advanced students, affords a digest of present day criticism of the theory of natural selection and a summary of important auxiliary or alternative theories. Annotated bibliographies.
Jordan & Kellogg, Dial, 43:210; Nation, 85:426. Kellogg, Ath. 1908, 1:388; Dial, 43:161; Nation, 85:475.
- 581.15 c Vries, Hugo de. Plant-breeding. Open Court \$1.50 n
- 7-19453 Popular presentation of recent developments in methods obtained by Nilsson in Sweden and Burbank in California, with clear discussion of underlying scientific principles and author's theory of mutation. 114 halftones. Can be heartily commended to the practical farmer and gardener as well as to the scientific student.
Botanical Gaz. 44:147; Dial, 43:43; Jour. of Philos. 4:606; Nation, 85:238.
- 581.6 Freeman, W. G. & Chandler, S. E. The world's commercial products. Pitman \$3.50
- 7-22708 Far from exhaustive and sometimes inaccurate, this descriptive account of the economic plants of the world and of their commercial uses brings together conveniently much practically useful material, with a wealth of excellent illustrations.
Annals of Amer. Acad. 31:709; Jour. of Polit. Econ. 15:644.
- 581.97 c Hough, R. B. Handbook of the trees of the northern states and Canada, east of the Rocky mountains. Hough \$8
- 7-31197 Popular description of appearance and habit of 208 species, concise scientific description and remarkably fine halftones showing trunk and bark, branchlet with leaves, fruit, winter twig and frequently cross-section. Ruled backgrounds show proportions on one-inch scale, reduced where necessary to page. A United States map, shaded to show distribution, accompanies each species. Synopsis of families and genera, analytical keys, glossary and index.
Botanical Gaz. 44:384; Dial, 44:18; Nation, 85:355.

- 590 Long, W. J.** Whose home is the wilderness. Ginn \$1.25 n
 7-37000 Ten sketches of wild life, relating personal observations of individual traits, and filled with appreciations of the beauty and spirit of the solitudes. Illustrated by Charles Copeland. Dial, 43:418.
- 590 Roberts, C. G. D.** Haunters of the silences. Page \$2
 7-18302 Vivid dramas of animal life beyond the range of ordinary observation in forest and deep sea, the dominant note being the fierce struggle for existence among all living creatures. Mr Bull's extremely clever and effective illustrations show the influence of Japanese art. Acad. 73:106; Ath. 1907, 2:587; Bookman, 25:305; Dial, 42:369; Nation, 84:591; N. Y. Times Sat. R. 12:361 (H. Hawthorne); Spec. 99:907.
- 590 Ward, J. J.** Some nature biographies: plant, insect, marine, mineral. Lane \$1.50 n
 8-12203 Eighteen papers revised from English magazines, giving life histories of several moths and butterflies, a horse-chestnut bud, a piece of coal, etc. Profusely illustrated from author's photographs and photomicrographs.
- 595.7 McCook, H. C.** Nature's craftsmen: popular studies of ants and other insects. Harper \$2 n
 7-12257 Twenty entertaining and scientifically accurate papers, reprinted in part from *Harper's Magazine*, on habits of ants, spiders, bees, wasps and other insects. Close to the ideal type of nature book, well written, well printed and well illustrated. *Nation*, 84:416. Ath. 1907, 1:764; Bookman, 25:624; Dial, 42:366; Independent, 62:1353; Nature, 76:516.
- 596 Velvin, Ellen.** Wild-animal celebrities. Moffat \$1 n
 7-31196 Studies made from personal observation of wild animals in captivity, with thrilling anecdotes of the experiences of their keepers and trainers. Independent, 63:1001; Nation, 85:520; N. Y. Times Sat. R. 12:740.
- 598.1 Ditmars, R. L.** Reptile book. Doubleday \$4 n
 7-10051 A comprehensive, popularized work on the structure and habits of the turtles, tortoises, crocodiles, lizards and snakes which inhabit the United States and northern Mexico. *Subtitle*. Eight colored plates and over 400 photographs from life; author curator of reptiles in N. Y. Zoological Park. It is safe to say that as a whole the photographs form a graphic representation of our reptilian fauna which is unsurpassed. *Nation*, 84:504. N. Y. Times Sat. R. 12:281.
- 598.2 Finley, W. L.** American birds: studied and photographed from life. Scribner \$1.50 n
 7-36870 Notebook and camera observations of 21 northwestern species, with special reference to conduct of parents at breeding time and appearance, growth and general characteristics of young. Style racy and careless. 127 remarkably interesting halftones.

- 7-17394 Gene Stratton-Porter's *What I have done with birds* (Bobbs-Merrill \$3 n) is a series of remarkable photographs of birds of the Wabash valley, taken at their nests, with text telling interesting personal adventures in securing the pictures.
Finley, Dial, 43:419; Independent, 64:51; Nation, 86:17. Porter, Bookman, 25:622; Dial, 43:216.

598.8 Chapman, F. M. Warblers of North America.
Appleton \$3 n

- 7-14643 Prepared, with the coöperation of other ornithologists, to serve as an aid to the field identification of warblers and to the study of their life histories. Contains many short bibliographies. Includes 55 species and 19 subspecies found north of Mexico. Shows in colors the male and female of each.
To the technical ornithologist, as well as to the amateur . . . this volume will be of constant use. *Nation*, 84:438.
Science, 49:305.

USEFUL ARTS

See also Juvenile, p. 43.

- 604 c Williams, Archibald. How it works. Nelson \$1.25
7-29122 Deals in simple language with steam, electricity, light, heat, sound, hydraulics, optics, etc. and with their applications to apparatus in common use.
Acad. 71:602; *Independent*, 62:737; *Outlook*, 85:813.
- 613 a Gulick, L. H. The efficient life. Doubleday \$1.20 n
7-11182 Simple, practical suggestions for busy people, about sleep, exercise, food, stimulants, etc., aiming to increase the brain worker's general efficiency. By director of physical training in New York public schools.
- 8-6051 Francis Cavanagh's *Care of the body* (Dutton \$2.50 n, Methuen 7/6 n), nontechnical papers for educated laymen on toilet, dress, exercise, sleep, etc. deals more with general principles, but definitely condemns certain mistaken conventions and practices.
Gulick, Dial, 42:258; *Nation*, 84:416. Cavanagh, *Ath.* 1907, 2:485; *Nation*, 86:359; *Sat. R.* 104, 16 Nov. '07, sup. p. 8.
- 613.5 c Gerhard, W. P. Sanitation of public buildings.
Wiley \$1.50
7-37728 Small book by an authority, practical, nontechnical and specific in treatment of hospitals, theaters, churches, schools, markets and abattoirs. Takes up fire protection, lighting and heating, as well as ventilation, drainage, etc.
Engin. Digest, 3:69; *Engin. News*, 58:655; *N. Y. Times Sat. R.* 13:40.
- 614.3 Wiley, H. W. Foods and their adulteration.
Blakiston \$4 n
7-19428 Treats popularly, but from a scientific standpoint, of the principal food products, their manufacture, properties, composition, forms of adulteration and dietetic value, and includes national food laws and regulations. By chief chemist of United States Department of Agriculture.
Nation, 85:213; *N. Y. Times Sat. R.* 12:404; *Science*, 49:714.

- 628 McCullough, Ernest.** Engineering work in towns and small cities. Technical Bk Agency \$3
- 7-19430 Practical advice on pavements, drainage, water supply, buildings, contracts, records, office systems, etc. for city officials without technical training and engineers inexperienced in municipal works.
- 7-21739 Hubbard & Kiersted's *Water works management and maintenance* (Wiley \$4) is a good general work, considering sources, purifying and storing, maintenance and operation, franchise, rates, etc.
- McCullough, Engin. News, 56:638. Hubbard & Kiersted, Engin. News, 58:294; Nature, 76:517.
- 631 b Burkett, C. W.** Soils: their properties, improvement, management, and the problems of crop growing and crop feeding. Judd \$1.25
- 7-29107 Practical, popular book for the farmer on soil making, feeding, tilling, draining and reclaiming, and the problems of crop growing.
- 7-6647 S. W. Fletcher's *Soils* (Doubleday \$2 n) while simple and non-technical, is less popular and more thorough and comprehensive in treatment. Both are fully illustrated.
- Fletcher, Nation, 85:19.
- 636 Voogt, Gos de.** Our domestic animals: their habits, intelligence and usefulness; tr. from the French by K. P. Wormeley; ed. for America by C. W. Burkett. Ginn \$3.50 n
- 7-40011 Popular, profusely illustrated with fascinating halftones and seven full-page colored pictures. For readers of all ages; especially useful in the children's room for reference use in connection with the schools. Well printed on glazed paper, heavy to handle.
- 637 Conn, H. W.** Practical dairy bacteriology. Judd \$1
- 7-36864 Pt 1, popular but thoroughly scientific discussion of milk bacteria, useful and harmful, and their relation to butter, cheese and public health; pt 2, directions for laboratory analysis. For students, dairymen and health officers.
- 7-23316 Jensen's *Essentials of milk hygiene* (Lippincott \$2 n) treats of milk from standpoint of sanitary supervision, and takes up its chemistry, its proper protection, relation to various diseases and the regulation of the milk business.
- Jensen, Ath. 1907, 2:243.
- 646 b Laughlin, C. E. ed.** The complete dressmaker. Appleton \$1.25 n
- 7-21284 Explains clearly the various processes of up to date (1907) dressmaking and millinery—cutting, fitting, sewing, decoration, mending and cleaning, covering frames, trimmings, etc. Authors Pratt Institute instructors. Illustrations give practical aid.
- 654.2 St John, T. M.** Wireless telegraphy for amateurs and students. T. M. St John \$1
- 7-481 Simple explanation of theory, with directions illustrated by drawings for experiments with homemade apparatus. By showing the relations between wire and wireless telegraphy, A. E. Kennelly in *Wireless telegraphy* (Moffat \$1) explains its principles and operations clearly without using algebra.
- 7-482 Kennelly, Nation, 85:257.

- 660** **b Duncan, R. K.** Chemistry of commerce: a simple interpretation of some new chemistry in its relation to modern industry. Harper \$2 n
- 7-31986 An excursion into the wonderland of chemistry. Describes the application of recent discoveries in chemistry to various manufactures and to the artificial production of hitherto rare substances used in making medicines, perfumes, fertilizers, etc. Independent, 63:823; Nation, 85:522; Nature, 77:49.
- 676** **Sindall, R. W.** Paper technology. Lippincott \$4 n
- Agr7-1598 Elementary, fairly nontechnical manual on manufacture, physical qualities and chemical constituents of paper and paper-making fibers. Intended rather for users than makers of paper, giving about half space to testing. Glossaries, abundant illustrations and index.
- 693.5** **Reid, H. A.** Concrete and reinforced concrete construction. Myron C. Clark Pub. Co. \$5 n
- 7-6665 Sound, conservative treatise dealing with both theory and practice, but especially strong in the latter. Excellent treatment of foundations, piers, piles, etc. *Pittsburg.*
- W7-241 *Concrete steel buildings* by W. N. Twelvetrees gives details of design and construction of reinforced concrete buildings in Europe and America, and instructive examples of constructive mishaps. Excellent index increases value as reference book. Both books illustrated by drawings and photographs. Reid, Engin. News, 57:301. Twelvetrees, Engin. News, 58:182; Nature, 76:516.

FINE ARTS

See also Juvenile biography, p. 45.

- 708.6** **Ricketts, C. S.** Art of the Prado. (Art galleries of Europe) Page \$2 n
- 7-30412 Most valuable both as a handbook to the Madrid gallery and as an artist's fresh and illuminating art criticism. 48 halftone reproductions.
- 7-38023 Perhaps the chief value of Calvert and Hartley's *The Prado* (Spanish ser. Lane \$1.25 n) lies in its 221 plates, less satisfactory than those in Mr Ricketts's book, but useful as an index of the gallery's best contents. Ricketts, Dial, 43:379; Nation, 85:550. Calvert, Ath. 1907, 2:487; N. Y. Times Sat. R. 12:463.
- 723.52** **Bond, Francis.** Gothic architecture in England. Scribner \$12 n
- 6-20691 Extraordinarily full, extraordinarily minute, and enriched by a wealth of illustrations, as well as most elaborate indexes, a very full bibliography, a chronologic table and many sheets of comparative moldings drawn to a uniform scale. *Spectator*, 96:150. A book that at once steps to the front as authoritative, and it will be long before it is superseded. *Athenaeum*, 1905, 2:871. Internat. Studio, 28:86; Nation, 83:126.

- 736** **Rowe, Eleanor.** Practical woodcarving: a book for the carver, the teacher, the designer and the architect. (Batsford 7/6 n) Lane \$3 n
- W7-124 Explicit, intended to serve student without a teacher. Author 20 years manager of South Kensington School of Art Wood Carving. 114 illustrations from photographs and 55 line drawings, showing the best historic examples of French and English carving. Internat. Studio, 31:251; Nation, 86:43; Spec. 98:722.
- 745** **Holland, Charles.** Design for schools: a handbook for teachers for use in secondary schools, the upper standards of elementary schools, and elementary classes of schools of art. Macmillan \$1.90 n
- E8-7 Monthly lessons, each fully illustrated, for a four years course. Beginning with elementary principles, makes gradual applications to wall papers, embroidery, lace, carpets, wrought iron, etc., imparting much valuable technical information. Ath. 1908, 1:167.
- 749** **Shackleton, Robert & Elizabeth.** Quest of the colonial. Century \$2.40 n
- 7-30414 Pleasant narrative of experiences of two enthusiastic collectors of old furniture. Describes searches in old towns of Eastern and Southern States, distinguishes various styles, and offers suggestions to prospective collectors. Over 50 halftones. Dial, 43:383.
- 750** **b Cox, Kenyon.** Painters and sculptors: a second series of "Old masters and new." Duffield \$2.50 n
- 7-31410 A practical artist's critical appreciations of The Pollaiuoli, Holbein, Rembrandt, Rodin, Lord Leighton, Painters of the mode, The education of an artist. Revised from magazine articles. Nation, 85:525; Putnam's, 3:957.
- 750** **Van Dyke, J. C.** Studies in pictures: an introduction to the famous galleries. Scribner \$1.25 n
- 7-9576 Points out some of the elements that may be looked for in various kinds of painting—landscapes, portraits, etc. Chapters on the restoration of old masters and on copies and forgeries. 39 halftones of celebrated paintings. Acad. 73:726; Dial, 43:95; N. Y. Times Sat. R. 12:300.
- 759.1** **c Caffin, C. H.** Story of American painting. Stokes \$2.50 n
- 7-36959 Traces various influences from colonial times to present, with much suggestive criticism. The physical makeup of the book is unfortunate and its 143 halftones, though helpful, are disappointing. Of special value to libraries which have not Isham's *History of American painting*, 1905, Macmillan \$5.
- 7-30413 J. W. McSpadden's *Famous painters of America* (Crowell \$2.50 n 927.5) makes no pretense at art criticism but gives anecdotal sketches of West, Copley, Stuart, Inness, Vedder, Homer, La Farge, Whistler, Sargent, Abbey and Chase. 38 halftones; bibliography. Caffin, Nation, 86:21; Putnam's, 3:359 (E. L. Cary). McSpadden, Dial, 43:379; Nation, 85:383.

- 759.2** **Phythian, J. E.** George Frederick Watts. (Famous artists and their work) Stokes \$1
- 8-35589 Popular little handbook, grouping work by subjects, as Myth and legend, Chivalry, Faith, hope and charity, Landscape, Portraiture, etc. and interpreting paintings as symbolic expressions of Watts's philosophy of life and nature. Illustrated.
- W7-158 Bayes's *Landscapes of George Frederick Watts* (Warne \$1.25 n), the second volume on Watts in the Newnes' art library, consists of a 13 page essay, 18 excellent reproductions tipped on tinted backgrounds, and a portrait of Watts.
- 759.6** **Bensusan, S. L.** Velasquez. (Masterpieces in color) (Jack 1/6 n) Stokes 65c n
- W8-31 A short biographic and critical essay, printed in wide-leaded, black face type and illustrated by eight colored plates. The series follows this plan, and the four volumes already issued have unusually satisfactory color prints.
Independent, 63:1466; N. Y. Times Sat. R. 12:835.
- 759.6** **Cole, Timothy.** Old Spanish masters. Century \$6 n
- 7-32152 Thirty-one wood engravings interesting as reproductions of the originals, and still more valuable as masterpieces of the engraver's art. The accompanying historical survey of Spanish art by C. H. Caffin is less illuminating than the engraver's admirable descriptive notes.
Ath. 1907, 2:775; Dial, 43:371; Nation, 85:574; Putnam's, 3:360.
- 760** **b Hayden, Arthur.** Chats on old prints. Stokes \$2 n
- 7-6391 Describes processes and qualities of etching, wood, steel and copper engraving, mezzotint, aquatint, lithograph, giving brief characterizations of principal engravers and hints to collectors of limited means. 110 halftone reproductions add greatly to practical value. Deals mainly with art in England.
- 6-33516 Lippmann's *Engraving and etching* (Scribner \$3.50 n), a translation of the handbook of the Royal Museum, Berlin, is called by the *Nation* "The best concise treatise . . . about the history of intaglio prints . . . to the beginning of the 19th century." Salaman's *Old engravers of England* (Lippincott \$2 n) gives lives of engravers (1540-1800) and reviews their work as mirroring contemporary social life. Hardie's *English coloured books* (Connoisseur's lib. Putnam \$6.75 n 765) is a clear, concise treatment, handsomely illustrated in color. Julia Frankau's *Eighteenth century colour prints* (Macmillan \$1.40 n 765) is a reprint of text only of the sumptuous work published in 1900 in editions costing from \$55 to \$175.
Hayden, Ath. 1906, 2:742; Sat. R. 103:150. Lippmann, Acad. 71:499; Ath. 1906, 2:279; Bookman, 24:640; Dial, 42:346. Salaman, Acad. 72:117; Ath. 1906, 2:742; Dial, 43:60; Nation, 85:268; Sat. R. 103:19; Spec. 97:938; Hardie, Ath. 1906, 2:555; Nation, 83:492. Frankau, Ath. 1906, 2:838.
- 770** **Guest, Antony.** Art and the camera. Macmillan \$2 n
- 7-35390 Clear and suggestive study of nature, genre and figure photography as a creative rather than a mechanical reproductive art, setting forth the principles underlying selection, composition and lighting and indicating the treatment of the negative and print to secure results resembling the beautiful photographs reproduced.

- 736 Rowe, Eleanor.** Practical woodcarving: a book for the carver, the teacher, the designer and the architect. (Batsford 7/6 n) Lane \$3 n
- W7-124 Explicit, intended to serve student without a teacher. Author 20 years manager of South Kensington School of Art Wood Carving. 114 illustrations from photographs and 55 line drawings, showing the best historic examples of French and English carving. Internat. Studio, 31:251; Nation, 86:43; Spec. 98:722.
- 745 Holland, Charles.** Design for schools: a handbook for teachers for use in secondary schools, the upper standards of elementary schools, and elementary classes of schools of art. Macmillan \$1.90 n
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- 749 Shackleton, Robert & Elizabeth.** Quest of the colonial. Century \$2.40 n
- 7-30414 Pleasant narrative of experiences of two enthusiastic collectors of old furniture. Describes searches in old towns of Eastern and Southern States, distinguishes various styles, and offers suggestions to prospective collectors. Over 50 halftones. Dial, 43:383.
- 750 Cox, Kenyon.** Painters and sculptors: a second series of "Old masters and new." Duffield \$2.50 n
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- 759.2** **Phythian, J. E.** George Frederick Watts. (Famous artists and their work) Stokes \$1
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- 6-28210 Hayden, Ath. 1906, 2:742; Sat. R. 103:150. Lippmann, Acad. 71:499; Ath. 1906, 2:279; Bookman, 24:640; Dial, 42:346. Salaman, Acad. 72:117; Ath. 1906, 2:742; Dial, 43:60; Nation, 85:268; Sat. R. 103:19; Spec. 97:938; Hardie, Ath. 1906, 2:555; Nation, 83:492. Frankau, Ath. 1906, 2:838.
- 6-18076 Julia Frankau's *Eighteenth century colour prints* (Macmillan \$1.40 n 765) is a reprint of text only of the sumptuous work published in 1900 in editions costing from \$55 to \$175.
- 770** **Guest, Antony.** Art and the camera. Macmillan \$2 n
- 7-35390 Clear and suggestive study of nature, genre and figure photography as a creative rather than a mechanical reproductive art, setting forth the principles underlying selection, composition and lighting and indicating the treatment of the negative and print to secure results resembling the beautiful photographs reproduced.

- 7-19429 Beck's *Art principles in portrait photography* (Baker & T. \$3 n) is a similar treatise devoted exclusively to portraits, emphasizing composition and treatment of backgrounds and using photographs and line drawing to demonstrate the argument of the text.
 Guest, Acad. 73:794; Internat. Studio, 32:337. Beck, Dial, 43:68; Nation, 85:241; N. Y. Times Sat. R. 12:446.

GARDENING

- 712 Barron, Leonard. Lawns and how to make them, together with the proper keeping of putting greens. (Garden lib.) Doubleday \$1.10 n
- 6-39021 Practical little book dealing with selection of site, grading, seeding and seed mixtures, turfing, mowing, enriching, rolling, watering, the weed problem, etc. 32 instructive halftones from photographs. Indexed.
- 716 c Rexford, E. E. Four seasons in the garden. Lippincott \$1.50 n
- 7-16936 Not a guide to the seasons in order, but a haphazard collection of papers containing valuable hints for simple gardening, indoors and out. 27 halftone plates, decorations and ornamental initials.
- 7-15329 Sedgwick's *Garden month by month* (Stokes \$4) is a reference book with tabular arrangement indicating appearance, color, method of cultivation and date of bloom of hardy plants for formal or wild gardens, with additional lists of aquatics, vines, etc. Folding color chart, full index of names, over 200 halftones.
 Rexford, Dial, 42:367; Nation, 85:547. Sedgwick, Dial, 42:368; Nation, 85:547; Outlook, 86:118.

MUSIC

- 780.9 c Elson, Arthur. Music club programs from all nations. Ditson \$1.25
- 7-39405 Provides historical and biographic outlines for each national school of music, with questions for study and a series of well arranged programs of graded difficulty.
 Dial, 44:12; Nation, 86:134.
- 780.9 Pratt, W. S. History of music: a handbook and guide for students. Schirmer \$3 n
- 7-38011 Of encyclopedic fulness, condensed in style, well arranged and indexed for quick reference. Specially valuable for descriptions and illustrations of musical instruments. Three maps show relation of musical centers.
- 7-35630 J. K. Paine's *History of music to the death of Schubert* (Ginn \$2.75 n) consists of Harvard lectures treating in a scholarly yet delightfully friendly style, musical development from Greek and Roman times to 1828.
 Dial, 44:99; Nation, 86:87.
- 789.9 Kobbé, Gustav. The pianolist: a guide for pianola players. Moffat \$1 n
- 7-40771 For those without musical training or knowledge of composers. Gives no instruction in manipulation of instrument, but shows how to study music by its aid.
 Nation, 86:110.

AMUSEMENTS AND SPORTS

See also Juvenile, p. 43-44.

- 796** **White, S. E.** Camp and trail. Outing \$1.25 n
 7-31474 Summary of results of author's out-of-door experiences in the form of explicit advice to woodsmen and amateur campers. Gives addresses of outfitting firms and manufacturers of supplies. Index and paragraph summaries. Not a complete pocket manual like Kephart's *Camping and woodcraft* (1906) but excellent within its limits. Illustrated.
 Dial, 43:419.
- 799** **Seton, Mrs Grace (Gallatin)** (*Mrs Ernest Thompson Seton*). Nimrod's wife. Doubleday \$2 n
 7-18186 Camping and hunting adventures of the author and her husband in the Sierras, Rockies, on the Ottawa and in Norway. Pervaded by enthusiasm for out-of-door life, love of adventure and a cheerful, wholesome philosophy. Admirable marginal illustrations.
 Acad. 73:107; Ath. 1907, 2:617; Dial, 43:212; Outlook, 86:476.

ANTHOLOGIES, PROSE AND VERSE

See also Juvenile, p. 44.

- 808.8** **Couch, A. T. Quiller-**, *comp.* The pilgrim's way: a little scrap of good counsel for travelers. Dutton \$1.50 n
 7-35145 Bits of prose and verse ranging from the Bible to Maeterlinck and Patmore, and providing good counsel and pleasant reflection for every stage of life's journey.
 Ath. 1906, 2:826; Dial, 41:457; Sat. R. 103:57; Spec. 97:733.
- 821.04** **Welsh, Charles**, *comp.* Golden treasury of Irish songs and lyrics. Dodge \$2.50
 7-11574 Includes sentimental, patriotic, convivial and humorous folk and street songs, translations from the Gaelic and poems of the current Irish revival. Arrangement alphabetic by author with three indexes, title, first line and general index, including title catchword, type, subject, pseudonym, etc.
 Nation, 84:570; Putnam's, 3:364.

POETRY

See also Anthologies, p. 21.

- 811.49** **Stringer, A. J. A.** The woman in the rain, and other poems. Little \$1.25 n
 7-37033 Poems touching the grimmest aspects of life with an ardent idealism, and showing dramatic power as well as artistic subtlety.
 Putnam's, 3:366.

ESSAYS, HISTORY OF LITERATURE, ETC.

- 804** **Matthews, J. B.** Inquiries and opinions. Scribner \$1.25 n
 7-29534 Observations on literary arts and crafts and the technic of some of the masters of literature, as: An apology for technic; Mark Twain; Poe and the detective story; The modern novel and the modern play.
 Dial, 44:137; Nation, 85:498.

- 807** *c* **MacClintock, P. L.** Literature in the elementary school. Univ. of Chic. \$1 n
- 7-37019 Discusses educational value of literature and applies underlying principles of selection to folk tales, myths, realistic, nature and animal stories, poetry, drama, etc. Studies methods of presentation, and gives lists of books suitable from first to eighth school years.
- 6-41522 J. R. Colby's *Literature and life in school*, 1906 (Houghton \$1.25) a "plea for the presence of literature in schools from the first day to the last," is developed along somewhat the same lines; not so direct and simple, but no less valuable and suggestive. Both are of general rather than exclusively pedagogical interest. MacClintock, Elem. School Teacher, 8:347.
- 809** **Saintsbury, G. E. B.** Later nineteenth century. (Periods of European lit. v.12) Scribner \$1.50 n
- 7-36994 A Pisgah view of the various European literatures, 1850-1900. Concludes with a short editorial resurvey of the history covered by the preceding volumes by several authorities, the whole forming a complete and continuous history of European literature. Acad. 74:481.
- 818.4** *c* **Grayson, David, pseud.** Adventures in contentment. Doubleday \$1.20 n
- 7-40003 A young man broken in health by the strain of city life buys a small farm and philosophizes cheerfully about the restful joys of an outdoor existence, his work, recreations, neighbors and books. Atlantic, 101:711; N. Y. Times Sat. R. 13:7; Outlook, 88:43.
- 818.4** *a* **Van Dyke, H. J.** Days off, and other digressions. Scribner \$1.50
- 7-33932 Twelve sketches having the fresh, out-of-door charm and agreeably elusive bookish flavor of the author's *Fisherman's luck* and *Little rivers*. Appeared in *Scribner's Magazine*. Ath. 1907, 2:687; Dial, 43:380; Outlook, 87:765.
- 820.9** **Ward, A. W. & Waller, A. R. ed.** Cambridge history of English literature. 14v. v.1, From the beginnings to the cycles of romance. Putnam \$2.50 n
- 7-40854 Comprehensive study of development of English language and literature to close of Victorian Age, each chapter to be the work of an authority, English, continental or American. J. E. Sandys, George Saintsbury, Israel Gollancz and W. P. Ker are among the 17 contributors to v. 1. Elaborate bibliographies for each chapter; index. Ath. 1907, 2:719; Nation, 86:575; Sat. R. 105:437.
- 824.89** *c* **Lucas, E. V.** Fireside and sunshine: essays. (Methuen 5/) Dutton \$1.25
- 7-29108 Piquant observations on "Elian" subjects, such as old clothes, toast, fireworks, walking sticks. Dial, 42:288; Nation, 84:339; Spec. 97:791.

- 826 *b* — *comp.* The gentlest art: a choice of letters by entertaining hands. Macmillan \$1.50 n
- 7-32334 Selected letters, chiefly of 18th and 19th century English authors, grouped under such captions as Children and grandfathers, The familiar manner, The grand style, Urbanity and nonsense, Literature and art, The pen reflective, Friendship and more, etc.
- 7-18132 A much more pretentious, but less fascinating, anthology is *Letters of literary men*, 2v. ed. by F. A. Mumby (Dutton \$1 n ea.), which represents English authors from 15th to 20th century, introducing each by a brief note.
Lucas, *Ath.* 1907, 2:797; *Nation*, 86:102; *Spec.* 99:874. Mumby, *Nation*, 86:102; *Spec.* 98:643.
- 828.8 *c* Sharp, William, "Fiona Macleod," *pseud.* Where the forest murmurs: nature essays. Scribner \$2 n
- 7-12864 Posthumous essays combining sincere and richly varied appreciations of nature's moods with quaint legendary lore. Has a touch of Gaelic mysticism, but no overelaborate symbolism.
Acad. 71:440; *Ath.* 1907, 1:164.

HUMOR

- 817 American wit and humor; by 100 of America's leading humorists; introd. by Joel Chandler Harris.
5v. Sold only in sets. Review of Reviews \$3
- 7-16476 Sketches and verses ranging in time from Benjamin Franklin to Carolyn Wells and in literary quality from Hawthorne to "Josiah Allen's Wife," with a few examples of undergraduate humor from college monthlies. Also an essay by A. B. Maurice on International wit and humor as expressed in caricature, with reproductions of famous cartoons.

DESCRIPTION AND TRAVEL

See also Juvenile, p. 44-45.

- 913.38 *c* Tucker, T. G. Life in ancient Athens.
Macmillan \$1.25 n
- 7-4807 A vivacious study of the social and public life from day to day of a classical Athenian (440-330 B.C.).
- 7-36949 T. D. Seymour's *Life in the Homeric age* (Macmillan \$4 n) is a lucid and scholarly reconstruction of the Homeric period from a study of the Homeric poems, of high value for students of Greek and for reference use. Bibliography. Both books are illustrated with maps and photographs of archeological remains.
Tucker, *Acad.* 72:188; *Dial.* 42:148; *Spec.* 98:379. Seymour, *Acad.* 73:182; *Ath.* 1907, 2:510; *Dial.* 43:311; *Nation*, 85:472; *Sat. R.* 105:82; *Spec.* 100:126.
- 914 Frazar, M. D. Practical European guide. Small \$1 n
- 8-4338 Not a descriptive guide. Gives compact and specific information about preparation, cost, routes and what to see, outlining several tours. Will help those who do not know how to plan or how far money will go.
- W7-145 Douglas Sladen's *Sicily, the new winter resort* (Dutton \$2 914.58) is encyclopedic, a marvel of condensed and authoritative information, with nearly 250 pictures, so compactly made up that its 616 closely printed pages make a volume of only moderate size.

- W8-12** H. A. Douglas's *Venice on foot* (Scribner \$1.50 914.53), almost pocket size, lays out 10 walks, providing historical notes on things to be seen, with 75 illustrations and 11 maps.
Frazar, *Dial*, 42:381. Sladen, *Cath. World*, 86:253; *Independent*, 62:1358; *N. Y. Times Sat. R.* 12:195. Douglas, *Ath.* 1907, 2:687; *Bookman*, 26:511; *Nation*, 86:38; *N. Y. Times Sat. R.* 13:90.
- 914.2** *c* **Bates, K. L.** *From Gretna Green to Land's End.*
Crowell \$2 n
- 7-32870** Describes entertainingly a summer trip through the west of England. Rich in literary and historical allusions. 24 halftones from original photographs. Most of it reprinted from the *Chautauquan*.
Dial, 43:377; *Nation*, 85:240.
- 914.2** **Bedford, Jessie**, "Elizabeth Godfrey," *pseud.* English children in the olden time. Dutton \$3 n
- W8-3** Historical survey of child life from Saxon times till end of 18th century, with chapters on toys, games, nursery lore, fairy tales and education. 32 interesting halftones after portraits and prints.
Ath. 1908, 1:470; *Sat. R.* 104, Dec. 7, '07, sup. p. 3; *Spec.* 99:398.
- 914.2** **Hueffer, F. M.** *England and the English.*
McClure \$2 n
- 7-19051** The book is not topographical or archeological, but an attempt to portray the spirit of the people. Impressionistic, attractive, but rather long drawn out and desultory. 16 halftone plates of London scenes.
Dial, 43:255; *Nation*, 85:148; *N. Y. Times Sat. R.* 12:662; *Outlook*, 86:646.
- 914.369** **Holbach, M. M.** *Dalmatia: the land where East meets West.* Lane \$1.50 n
- 7-42481** Describes the scenery, life, architecture and archeology of this interesting and little traveled Austrian dependency on the east side of the Adriatic, the home of successive civilizations. 50 excellent halftones. Map.
Acad. 73:673; *Sat. R.* 104:486; *Spec.* 99:673.
- 914.38** *b* **Van Norman, L. E.** *Poland, the knight among nations.* Revell \$1.50 n
- 7-32871** Indorsed by Madame Modjeska as exceptionally discriminating impressions of her unfortunate nation. Best in its portrayal of modern activities and accomplishments. Partly reprinted from popular magazines.
Bookman, 26:415; *Dial*, 44:137; *Outlook*, 87:747.
- 914.4** *b* **Edwards, M. B. Betham-**. *Literary rambles in France.* McClurg \$2.50 n
- 7-36931** Flaubert, Balzac, George Sand, Michelet, Prosper Mérimée, Carcassonne, its poet and poetizer, the Marseillaise, are among the subjects met in these delightful reminiscences of travel.
Acad. 73:668; *Ath.* 1907, 1:758; *Dial*, 43:290; *Nation*, 86:239; *Putnam's*, 3:243; *Spec.* 99:266.

- 914.4 Maud, C. E.** *Felicity in France.* Scribner \$1.50 n
 W6-392 Felicity chaperones a sprightly and energetic aunt on an autumn tour through Brittany, Touraine and Provence. Conveys sympathetic and humorous impressions of people and places, and enchanting glimpses of French life.
- 7-31243 Josephine Tozier's *Spring fortnight in France*** (Dodd \$2 n) is a vivacious combination of romance and notes of an actual holiday journey through central and southern France from Le Mans to Marseilles. Illustrated from photographs and drawings.
 Maud, Acad. 71:10; Ath. 1906, 2:71; Nation, 83:414; N. Y. Times Sat. R. 11:770; Spec. 97:173. Tozier, Dial, 43:378; Outlook, 87:498.
- 914.4 c Wendell, Barrett.** *France of today.* Scribner \$1.50 n
 7-29424 Lowell lectures on The universities; The structure of society; The family; The French temperament; Relation of literature to life; The question of religion; The revolution and its effects; The republic and democracy.
 Full of excellent things; the author combines acumen with sympathy. He knows how to praise and he also knows how to blame, a much rarer art. *J. A. J. Jusserand, N. Y. Times Sat. R.* 12:742.
- 914.47 b Gould, Sabine Baring-** *Book of the Pyrenees.*
 Dutton \$1.50 n
 7-35350 Deals interestingly with the character and history of French towns and countrysides from Bayonne to Perpignan. 25 halftones from photographs.
 Rarely is a book of this kind so fascinating. . . Can be heartily commended both to those who travel and those who stay at home. *Nation*, 85:236.
 Ath. 1907, 1:788; Sat. R. 103:434.
- 914.55 Lees, D. N.** *Scenes and shrines in Tuscany.*
 Dutton \$1.25 n
 7-29127 Enthusiastic narrative of author's observations and experiences while living in an Italian household. She describes a mushroom hunt, harvest, vintage, Easter in Florence, the day of the dead, etc.
 Acad. 72:533; Nation, 85:14; Spec. 98:947.
- 914.57 Vaughan, H. M.** *The Naples Riviera.*
 (Methuen 6/) Stokes \$2
 7-42348 Combines history, folklore and literary reminiscence with appreciative descriptions of scenery. Includes the bays of Naples and Salerno and the neighboring isles of Ischia and Capri; 125 color plates.
 7-42023 Platt's *Through Italy with car and camera* (Putnam \$5 n 914.5) is a readable record of a motor car journey zigzagging across northern and central Italy and visiting many places not included in the ordinary itinerary; 200 illustrations from photographs of paintings, architecture, scenery and bits of life en route.
 Vaughan, Ath. 1907, 1:573; Nation, 85:567; Sat. R. 103:434. Platt, Dial, 44:107; Putnam's, 3:624.
- 914.64 Dick, Stewart.** *Heart of Spain.* Jacobs \$1.25
 7-42350 An artist's impression of Toledo, skilful in word painting, penetrating in criticism. 22 halftones from photographs with five color plates and eight pen and ink sketches after author's work.

- W8-6 Calvert's *Toledo* (Spanish ser. Lane 3/6 n \$1.25 n) consists of a too careless and inaccurate historical and descriptive sketch of 169 p. followed by 511 halftone plates, which though sometimes far from satisfactory, furnish, on the whole, an unusually valuable collection for the price.
Dick, Ath. 1907, 1:574. Calvert, Ath. 1908, 1:352; Nation, 85:443.
- 914.69 **Hume, M. A. S.** Through Portugal. McClure \$2 n
7-25498 His vivid description of the scenery and the people, and his observations on art, history and archeology make up a book of more than usual interest and charm. *A. L. A. Booklist*.
31 plates from A. S. Forrest's color sketches and eight from photographs.
Ath. 1907, 1:350; Dial, 42:373; Nation, 85:236; Sat. R. 103:434.
- 914.7 **Pares, Bernard.** Russia and reform. Dutton \$3 n
7-38525 Sane, scholarly and competent account of Russia's development, with analysis of the character and ideals of her people, making comprehensible the present revolutionary movement and the points at issue. Approaches Mackenzie Wallace and Leroy-Beaulieu as a work of permanent value. Prince Michael Trubetzkoi's *Out of chaos* (Longmans 6/ \$2, 923.427) is a naïve and interesting personal record of his unsuccessful attempt to help the oppressed peasantry, and subsequent identification with the revolutionary movement.
Pares, Ath. 1907, 1:439; Nation, 85:332; Outlook, 86:971; Spec. 98:675. Trubetzkoi, Ath. 1907, 2:549; Spec. 99:1100.
- 914.92 **Tomalin, H. T.** Three vagabonds in Friesland, with a yacht and a camera.
(Simpkin 7/6 n) Dutton \$3 n
8-35073 A book of photographs and thumb-nail sketches "with letter-press obligato" recording a holiday trip and conveying the quaintness and charm of northern Holland.
Internat. Studio, 32:251; Nation, 85:263; Sat. R. 103:434.
- 915.1 **b Smith, A. H.** China and America today: a study of conditions and relations. Revell \$1.25 n
7-26625 Briefly surveys changed conditions in both countries. Charges America with unjust and short-sighted attitudes and points out her responsibilities toward the Far East. Author for 35 years a missionary in China. His *Uplift of China* (Young People's Miss'y Movement 50c 275.1) is a handbook for missionary study, giving in condensed form much information about old and new China and defining conditions and problems which confront the missionary. Excellent maps and bibliographies. Martin's *The awakening of China* (Doubleday \$3.80 n) is an optimistic study of the development and present status of the reform movement in China. Dr Martin was over 50 years a resident in China and president of the New Imperial University until 1900.
7-38590 Smith, China and America today, Independent, 63:942. Smith, Uplift of China, Outlook, 86:792. Martin, Ath. 1907, 2:439; Nation, 85:60; Spec. 99:743.
- 915.4 **c Low, S. J. M.** A vision of India, as seen during the tour of the Prince and Princess of Wales.
Dutton \$3.50 n
W7-6 Illuminating impressions of India's "splendor and contradictions, color and mystery, wealth and poverty, medley of classes, creeds

and peoples," by a special correspondent who accompanied the Prince of Wales in 1905-6. Map and 45 halftone plates.

8-5823

The author's humorous drawings in text and halftones from his sketches constitute a main value in Walter Crane's *India impressions* (Macmillan \$2.50). *A Corner in India* by Mrs M. M. Clark (Amer. Baptist Pub. Soc. \$1) is an unusually spirited and enlightening narrative of pioneer missionary work among the Nagas, a warlike tribe of Assam, describing home and village life, worship, customs, etc.

7-20732

Low, Ath. 1906, 1:606; Dial, 42:372; Nation, 85:15; Spec. 97:131. Crane, Ath. 1907, 2:580; Nation, 86:103; Spec. 99:781. Clark, Dial, 43:212; Nation, 85:120.

915.6

b Bell, G. L. Syria: the desert and the sown. New cheaper ed. Dutton \$3 n

7-35188

Syrian journeys of an Englishwoman of archeological enthusiasm and genuine feeling for oriental temperament and atmosphere.

7-37961

Grant's *Peasantry of Palestine* (Pilgrim Press \$1.50 n 915.69) describes in detail the life and customs of a village near Jerusalem, as observed during three years' residence. Dunning's *Today in Palestine* (Pott \$2.50 n 915.69) is a book for the traveler, embodying observations and experiences of 10 journeys. *Tent and Testament* by Herbert Rix (Scribner \$2.50 n 915.69) is an

7-38636

7-15906

W6-191

interesting and scholarly record of a camping tour extending beyond the beaten route. The author is chiefly concerned with identification of biblical sites and verification of biblical allusions. Matilde Serao's *In the country of Jesus* (1905) gives the impressions of a fervent Roman Catholic who accepts without question the traditional sites. All are quite fully illustrated with halftones from photographs.

Bell, Acad. 72:210; Ath. 1907, 1:159; Dial, 42:371; Nation, 84:437; Sat. R. 103:276; Spec. 99:253. Dunning, Nation, 86:125. Rix, Ath. 1907, 1:351; Spec. 98:94. Serao, Spec. 96:64.

916.75

Starr, Frederick. The truth about the Congo.

Forbes \$1

7-20882

Letters reprinted from the *Chicago Tribune* giving a distinguished ethnologist's impressions gained during a year's travel. He thinks the evils existing only such as must follow the white man's attempt to rule primitive peoples and discourages American intervention.

7-17352

Morel's *Red rubber* (Amer. Tract Soc. \$1.25) tells the story of the rubber slave trade, emphasizing its horrors and passionately calls on Great Britain to interfere.

Starr, Cath. World, 85:840; Nation, 85:281. Morel, Ath. 1906, 2:580.

917.19

b Wallace, Dillon. The long Labrador trail.

Outing \$1.50 n

7-17002

Tells of the successful accomplishment of the work of exploration begun by the disastrous Hubbard expedition (1903) described in his *Lure of the Labrador wild*.

7-20631

Townsend's *Along the Labrador coast* (Estes \$1.50) is a narrative of a summer coasting tour, describing scenery, birds, flora, geology, fish and fishermen, Eskimos, Hudson Bay Company's posts and Dr Grenfell's mission. Each has map and some 30 halftones.

Wallace, Dial, 42:374; Nation, 85:100. Townsend, Nation, 85:450.

- 917.2 Winter, N. O.** Mexico and her people of today. Page \$3
 7-34163 Up to date information on customs, characteristics, amusements, antiquities, resources, development, etc. in popular, readable form. Based on travel and extended reading.
- 8-4360 P. F. Martin's** *Mexico of the twentieth century*, 2v. (Dodd \$8.50 n) is an optimistic picture of prosperity and progress, reinforced by abundant statistics, describing in detail, government, industries, commerce, railways, products, etc. Both contain maps and halftones from photographs.
 Winter, Dial, 43:378; Nation, 86:221. Martin, Ath. 1907, 2:549; Spec. 99:990.
- 917.292 Henderson, John & Forrest, A. S.** Jamaica. Macmillan (6/n) \$2 n
 7-20521 Light, popular description of Jamaican life, history, trade and politics. Text and 24 colored illustrations taken from Henderson and Forrest's *West Indies* (1905, A. & C. Black 20/n 917.29). Independent, 62:614; Nation, 84:88; Outlook, 85:331.
- 917.3 c Paine, R. D.** The greater America. Outing \$1.50 n
 7-14803 Optimistic account of a western journey undertaken to investigate the possibilities of our sea traffic, mineral deposits, forests, prairies and deserts, and to hobnob with the "real men" who are developing these resources. 51 halftones.
 Annals of Amer. Acad. 30:599; N. Y. Times Sat. R. 12:303.
- 917.4 Abbott, K. M.** Old paths and legends of the New England border: Connecticut, Deerfield, Berkshire. Putnam \$3.50 n
 7-40881 Describes appreciatively the natural beauties of Connecticut and western Massachusetts, relating the fact or fiction which links each spot with the life of the past. 167 halftones, five in tint. Map.
 Crawford's *Little pilgrimages among old New England inns* (Page \$2) agreeably combines stories and pictures of quaint old hostelrys having historical, literary or romantic associations.
 Abbott, Nation, 86:79. Crawford, Dial, 43:427; Nation, 86:79.
- 917.8 Prudden, T. M.** On the great American plateau. Putnam \$1.50 n
 7-1482 Impressionistic portrayal of formation, scenery, present and past inhabitants and life of the stranger in the desert solitudes of Wyoming, Arizona and New Mexico. Maps, original photographs and drawings.
 Annals of Amer. Acad. 29:646; Dial, 42:374; Nation, 84:360.
- 918 Hale, Albert.** South Americans: the story of the South American republics, their characteristics, progress and tendencies: with special reference to their commercial relations with the United States. Bobbs-Merrill \$2.50 n
 7-36231 Covers Brazil, Uruguay, Argentina and Venezuela. Helpful and interesting as a guide to travel with historical notes but less valuable in its philosophic generalizations. 67 halftones.

- 7-38359 Enock's *The Andes and the Amazon* (Scribner \$5 n 918.5) is a mining engineer's observations on social and economic conditions in Peru today, a "practically unexplored country of vast possibilities." Illustrated with author's sketches and photographs. Hale, Dial, 44:107; Nation, 85:587; Sat. R. 104:640. Enock, Acad. 73:163; Ath. 1907, 2:679; Dial, 44:107; Nation, 86:423; Sat. R. 104:640.

- 919.14 Russel, Mrs F. K. A woman's journey through the Philippines. Page \$2.50

- 7-23256 Roundabout voyage among the southern Philippines (1900), in the United States cable ship Burnside. Entertaining record of travel, incidentally conveying much curious information. Maps and 40 halftones.

- 7-32869 H. M. Wright's *Handbook of the Philippines* (McClurg \$1.40 n) is perhaps overoptimistic, but valuable to tourists, business men and promoters as a reference book covering industrial conditions. Statistical appendixes, three maps, 150 halftone reproductions on 49 plates.

Russel, N. Y. Times Sat. R. 12:702. Wright, Nation, 85:564.

- 919.8 c Peary, R. E. Nearest the pole: a narrative of the polar expedition of the Peary Arctic Club in the S. S. "Roosevelt." (Geog. lib.) Doubleday \$4.80 n

- 7-35225 Graphic narrative of the expedition of 1905-6, when the American flag was planted at the "farthest north" point yet reached (87° 6'), with brief report of expedition of 1898-1902. 95 excellent halftones and two maps.

Ath. 1907, 2:118; Bookman, 25:424; Dial, 42:304; Nation, 85:41; Spec. 99:435.

HISTORY OF FOREIGN COUNTRIES

- 943.6 c Colquhoun, A. R. & Mrs Ethel. The whirlpool of Europe: Austria-Hungary and the Habsburgs.

Dodd \$3.50 n

- 7-10613 Popular account of present political, social and racial conditions in the heterogeneous countries comprising Austria-Hungary, with historical survey of their development and of the career of the house of Habsburg. Ten historical sketch maps, five race diagrams and 90 halftones.

Ath. 1907, 1:320; Nation, 85:146; Spec. 98:832.

- 943.64 Grohman, W. A. Baillie. The land in the mountains: being an account of the past and present of Tyrol.

Lippincott \$3 n

- 7-31993 Tells story of the Tyrol, not as connected history but dealing with people, places and events from Roman times to the present. Includes accounts of the Brenner pass, the famous Fugger family, peasant life, and noted castles and their art treasures.

Acad. 73:231; Ath. 1907, 2:231; Dial, 44:105; Sat. R. 103:754; Spec. 99:97.

- 945.8 a Trevelyan, G. M.** Garibaldi's defense of the Roman republic. Longmans \$2 n

7-21750 Detailed history of the defense and retreat (1849), based on careful study of records and scenes. Written with enthusiasm and dramatic power which hold reader's attention.

He would be a dull man indeed whose blood was not stirred by this splendid description of an heroic episode. *Academy*, 72:455. Lond. Times lit. sup. 6:130, Apr. 26, '07; Nation, 84:569.

- 949.5 Jorga, N.** Byzantine empire. (Temple cyclopaedic primers) (Dent 1/n) Macmillan 40c n

8-9087 Narrates history from year 400 to fall of Constantinople, 1453, in very compact compass yet in surprisingly lively and interesting style.

- 952 c Sakurai, Tadayoshi.** Human bullets.

Houghton \$1.25 n

7-31244 A Japanese soldier's story of Port Arthur. It reveals the exaltation of spirit, devotion to duty and complete self-surrender which made General Nogi's army invincible.

Ath. 1907, 2:616; Bookman, 26:414; Dial, 43:289; Nation, 85:492.

AMERICAN HISTORY

- 970.1 Curtis, Natalie, ed.** The Indians' book.

Harper \$7.50 n

7-31183 Songs and legends taken from the lips of American Indians. The songs appear both in original and translation and many musical notations are given. Illustrated with portraits, Indian drawings, etc. Undertaken to preserve their lore for the Indians, but of high interest to students of primitive literature, decorative art and music.

Dial, 43:382; Nation, 85:428; Outlook, 87:358.

- 970.3 c Schultz, J. W.** My life as an Indian: the story of a red woman and a white man in the lodges of the Blackfeet. Doubleday \$1.50 n

7-6737 Romantic, yet substantially true account of life among the Blackfoot Indians by a white man who married into their tribe and lived many years among them. Published originally in *Forest and Stream* under the title *In the lodges of the Blackfeet* and the pseudonym W. B. Anderson.

7-33219 Eastman's *Old Indian days* (McClure \$1.50 813.49) consists of legends and stories illustrating the nobler and more poetic phases of Indian life and showing them hunting, love-making, feasting, in camp and at war. Dr Eastman, a full-blooded Sioux, is the author of *Indian boyhood*.

Schultz, Ath. 1907, 1:788; Nation, 84:339; Sat. R. 104:304; Spec. 99:134. Eastman, N. Y. Times Sat. R. 12:866; Putnam's, 3:621.

- 973 Hart, A. B. ed.** The American nation. 27v. v. 20-27. Harper \$2 ea.

v.20, 7-4798 The index volume (1908) completes this coöperative history
v.21, 7-7446 of the United States from the beginnings to 1907. As a whole,
v.22, 7-24164 remarkably successful in its aim of being both readable and

- v.23, 7-33222 authoritative, it is of course impossible that the volumes on
 v.24, 7-33614 the latest events should be final.
 v.25, 7-41116 Amer. Hist. R. 13:591; Dial, 44:309; Nation, 86:285.
 v.26, 7-41115
 v.27, 8-2970

973.3 **Smith, J. H.** Our struggle for the fourteenth colony:
 Canada and the American Revolution. 2v.

Putnam \$6 n

- 7-26025 Detailed history of the efforts to secure Canada at the outbreak
 of the Revolution. Based on faithful research among manuscript
 sources. Interestingly written, its indisputable value is occasion-
 ally lessened by an effort to supply from probabilities what no
 records have preserved.
 Dial, 44:335; Nation, 86:494; N. Y. Times Sat. R. 12:540; Out-
 look, 87:311.

973.782 **Alexander, E. P.** Military memoirs of a Confederate:
 a critical narrative. Scribner \$4 n

- 7-16778 Campaigns of Army of Northern Virginia, with criticism of
 tactics and strategy of both sides. No preceding book by a
 southern soldier surpasses this in good temper, wise discrimina-
 tion and graphic portrayal. Intended particularly for military
 students but of great interest to the general reader.

Nation, 84:542.

Amer. Hist. R. 13:163; Annals of Amer. Acad. 30:605; Dial,
 42:332; Outlook, 87:494.

BIOGRAPHY

See also Juvenile, p. 45.

Bernhardt, Sarah. Memories of my life.

Appleton \$4 n

- 7-34323 An unconscious but complete and merciless revelation of the
 character of a remarkable woman and great artist; versatile,
 brilliant, reckless, egotistic and always interesting.
 Ath. 1907, 2:592; Dial, 43:279; Nation, 85:403; Sat. R. 104:693.

Bishop. Stoddart, A. M. Life of Isabella Bird (Mrs
 Bishop). Dutton \$5 n; new cheaper ed. \$2 n

- 7-25137 By a warm friend of the well known traveler. Gives a partial
 record of her travels, with an account of the more personal and
 religious side of her life, making frequent extracts from her
 letters.

Ath. 1907, 1:283; Nation, 84:547; Outlook, 85:902; Sat. R.
 104:303; Spec. 98:114.

Cipriani, Lisi. A Tuscan childhood. Century \$1.25 n

- 7-31991 Reminiscences of child life in a patrician Italian family, in
 which seven lively and original children were disciplined and edu-
 cated by English nursery governesses and German tutors. Though
 some children might enjoy it, the point of view makes it rather
 questionable for the children's room.

Dial, 44:111; Nation, 85:544.

- Cooke. Oberholtzer, E. P.** Jay Cooke, financier of the Civil War. 2v. Jacobs \$7.50 n
- 7-33957 Not only an interesting biography of a man of unique power and personality but also one that throws light on the public life, business methods and moral standards of the decade from 1861 to 1873. *Dial*, 44:15.
Nation, 85:546; N. Y. Times Sat. R. 12:710; Outlook, 87:790.
- Douglass. Washington, B. T.** Frederick Douglass. (Amer. crisis biog.) Jacobs \$1.25 n
- 7-8512 Story of the negro leader and orator's life as slave, and career as a public man during the reconstruction and following years, told with simplicity and moderation. Chapters on antislavery agitation, fugitive slave law, etc.
Ath. 1907, 2:397; *Dial*, 42:345; Nation, 24:589; Putnam's, 3:105; Spec. 99:437.
- Emerson. Woodberry, G. E.** Ralph Waldo Emerson. (Eng. men of letters) Macmillan 75c n
- 7-3927 Emerson's thought has never been so clearly and completely exhibited; and therefore this brief critical biography supplants all its predecessors. *North Amer. R.* 185:83.
Nation, 84:179; Putnam's, 3:107.
- Gilbert. Browne, E. A.** W. S. Gilbert. (Stars of the stage) Lane \$1 n
- 7-32813 Gilbert, the man, the Bab balladist, and the playwright. Of value rather as biography than as a critical estimate of his work. Acad. 73:724; Nation, 85:451.
- Godkin. Ogden, Rollo, ed.** Life and letters of Edwin Lawrence Godkin. 2v. Macmillan \$4 n
- 7-12877 Follows the career of the distinguished journalist, friend of Lowell, Garrison, Charles Eliot Norton, James Bryce, etc., who, as founder and editor of the *Nation*, exerted an inspiring influence on politics and public morals.
Atlantic, 100:421; *Dial*, 42:216; Nation, 84:360; N. Y. Times Sat. R. 12:252; Putnam's, 3:110; Spec. 98:797.
- Gosse, Edmund.** Father and son: biographical recollections. Scribner \$1.50 n
- 7-36407 Autobiographic recollections giving an amazingly delicate and temperate record of a father's mistaken attempt to force rigid Calvinistic doctrine on a lonely and imaginative child.
Acad. 73:188; Bookman, 26:527; *Dial*, 44:96; Nation, 86:197.
- Haydon, A. L. comp.** Book of the V. C. Dutton \$1.50
- 7-20536 A book of heroic adventures which have earned the Victoria Cross, with brief account of its origin and full list of recipients.
- Hudson. Bacon, E. M.** Henry Hudson: his times and his voyages. (Amer. men of energy ser.) Putnam \$1.35 n
- 7-38631 Describes adventures during four voyages and estimates explorer's character and achievements. Based on contemporary documents. Illustrated.
Independent, 64:976; N. Y. Times Sat. R. 13:170.

- Johnston, R. M.** Leading American soldiers. (Biog. of leading Amer.) Holt \$1.75 n
- 7-24610 Outlines main facts of lives and campaigns of Washington, Greene, Andrew Jackson, Taylor, Scott, Grant, Sherman, Sheridan, McClellan, Meade, Lee, Stonewall Jackson, J. E. Johnston. Their principal battles are treated in considerable detail, which makes the book a composite military history from the viewpoint of the dominant personalities.
Acad. 73:140; Dial, 43:124; Nation, 85:378; Putnam's, 3:101; Spec. 99:673.
- c Mistral, Frédéric.** Memoirs. 1830-1877.
Baker & T. \$3.50
- 8-8543 Delightful narrative, revealing a refreshing and magnetic personality, of the early years (1830-59) of the Provençal poet. 12 portraits and three other illustrations.
Ath. 1907, 2:577; Dial, 44:36; Nation, 84:65; Sat. R. 104:700.
- Paderewski. Baughan, E. A.** Ignaz Jan Paderewski. (Living masters of music) Lane (2/6 n) \$1 n
- 8-35168 Sketch of Paderewski's musical career with a temperate interpretation of his genius as pianist and composer; by a distinguished London musical critic.
Ath. 1908, 1:203; Nation, 85:524.
- Pollaiuolo. Cruttwell, Maud.** Antonio Pollaiuolo. (Lib. of art) Scribner \$2 n
- 7-28946 First monograph on this famous draftsman, painter, sculptor and goldsmith of the early Renaissance. Carefully distinguishes his work from that of his less gifted brother, Piero. 51 excellent halftones.
Acad. 72:208; Nation, 84:528; N. Y. Times Sat. R. 12:85.
- Rabelais. Tilley, Arthur.** François Rabelais. (French men of letters) Lippincott \$1.50 n
- 7-29040 Biographic and critical monograph, by a well equipped student of French literature. Gives in popular style all that the general reader seeks.
Acad. 73:133.
- Roosevelt. Morgan, James.** Theodore Roosevelt, the boy and the man. Macmillan \$1.50 n
- 7-31182 Not an intimate character study like the books by Reis, Leupp and Burroughs, nor a criticism of the President's policies; rather, a simple and interesting chronologic account of Roosevelt's career.
Nation, 85:424; N. Y. Times Sat. R. 12:610.
- Saint-Gaudens. Cortissoz, Royal.** Augustus Saint-Gaudens. Houghton \$7.50 n
- 7-40526 Brief monograph on the sculptor's career, embodying a discriminating criticism of his plastic gifts. 24 attractive color-plate reproductions.
Ath. 1908, 2:200; Dial, 44:370; Nation, 84:522; Sat. R. 104:773; Putnam's, 3:370; Spec. 99:662.

- c Schaff, Morris.** Spirit of old West Point, 1858-1862.
Houghton \$3 n
- 7-32862 A generously idealized but essentially truthful estimate of the molding influences which transform crude boys into "soldiers and gentlemen." Deals in happiest reminiscent vein with the four stirring years at the academy from 1858-62 and follows northern and southern classmates into the Great Struggle.
Dial, 43:310; Nation, 85:499.
- a Schurz, Carl.** Reminiscences. 2v. McClure \$6 n
- 7-36232 Schurz as German student and revolutionist (1848), American diplomat and Union general. Closes in 1863 after Chancellorsville. Mirrors a character distinguished for keen judgment, zest in affairs and persistent idealism.
Bookman, 26:661; Dial, 43:413; Nation, 86:60.
- Shakspeare. Raleigh, Walter.** Shakespeare. (Eng. men of letters) Macmillan 75c n
- 7-15578 Short monograph, mainly an interpretation of the man from his dramas.
An essay overflowing with life, crammed with suggestion, full of stimulating ideas and happy turns of phrase. It is table talk in *excelsis*. *London Times* lit. sup. 6:129, Apr. 26, '07.
Ath. 1907, 1:689; Bookman, 26:155; Nation, 84:454; North Amer. R. 185:780; Putnam's, 2:727; Sat. R. 104:145; Spec. 98:942.
- Spenser. Tuckwell, William.** Spenser. (Bell's miniature ser. of great writers) Macmillan 50c
- W7-87 Convenient little handbook, well printed and illustrated, providing an excellent introduction to the reading of Spenser's poetry.
- b Washington. Wister, Owen.** The seven ages of Washington: a biography. Macmillan \$2 n
- 7-38230 Will attract by an unusually clear, pleasing page and appropriate binding, and hold with its compact and skilful etching of a virile and human personality.
Dial, 43:424; Nation, 86:102.

FICTION

See also Juvenile, p. 45-47.

- c Andrews, Mrs M. R. S.** The militants: stories of some parsons, soldiers and other fighters in the world. Scribner \$1.50
- 7-18098 Nine short stories of somewhat uneven merit, three touching on the supernatural and all more than ordinarily interesting.
Nation, 85:58; Outlook, 86:476.
- Benson, E. F.** Sheaves. Doubleday \$1.40 n
- 7 29434 Study of a marriage, ideal in its union of beauty, talent and sympathetic tastes, but problematic on account of the wife's 17 years seniority. Written with delicate insight and in a light, unforced style.
Acad. 74:493; Ath. 1908, 1:155; Bookman, 26:555; Dial, 44:132; Nation, 86:128; Sat. R. 105:112; Spec. 100:268.

Benson, R. H. A mirror of Shalott: being a collection of tales told at an unprofessional symposium.

Benziger \$1.25 n

- 7-21227 Thirteen stories of the supernatural, purporting to be told by a group of Catholic priests and laymen from their own experiences. Ath. 1907, 1:789; Cath. World, 86:257; Nation, 85:167; Spec. 98:1038.

c **Brown, H. D.** Mr Tuckerman's nieces.

Houghton \$1.50

- 7-32838 The quiet eastern home of a bachelor university professor of settled and rather selfish habits is invaded by three orphan nieces from Chicago, to the ultimate happiness of all concerned. Interesting to older girls.

a **Bryant, S. C.** Stories to tell to children.

Houghton \$1 n

- 7-36089 Fifty-one stories in form for telling, with some suggestions for the teller.

b **Burnett, Mrs Frances (Hodgson).** The shuttle.

Stokes \$1.50

- 7-29574 Somewhat highly colored tale of modern knight-errantry, in which a valiant younger daughter goes forth to rescue her sister, the victim of a mistaken international marriage. Acad. 73:145; Ath. 1907, 2:513; Bookman, 26:272; Dial, 43:318; Nation, 85:474; Putnam's, 3:489; Sat. R. 104:642.

Calkins, F. W. The wooing of Tokala. Revell \$1.50

- 7-16943 An Indian knight-errant achieves deeds of prowess for his own honor and to win the maiden of his choice. Intimate study of Indian life. Nation, 84:591.

Connolly, J. B. The crested seas. Scribner \$1.50

- 7-30867 Thirteen stories portraying the hardship, peril and romance of the Gloucester fisherman's life in Newfoundland waters, and interpreting his fine as well as rough and rugged qualities. Spec. 100:67.

a **Couch, A. T. Quiller-, "Q,"-pseud.** Major Vigoureux.

Scribner \$1.50

- 7-30166 Quaint romance of a dismantled military post in the Scilly islands, reciting in humorous yet pathetic vein the commandant's belated love affair. Acad. 73:192; Ath. 1907, 2:580; Dial, 44:43; Nation, 85:328; Spec. 99:408.

Crawford, F. M. Arethusa. Macmillan \$1.50

- 7-33911 Story of adventure amidst the plots for the imperial throne at Constantinople (1376), in which a Venetian soldier of fortune and a beautiful slave girl of noble family are the chief characters. Acad. 73:251; Ath. 1907, 2:613; Bookman, 26:268; Sat. R. 104, sup. Oct. 19, '07, p. 7.

- b Cutting, Mrs M. S. D.* The suburban whirl, and other stories of married life. McClure \$1.25
- 7-33206 Four human, sympathetic stories of everyday social and domestic difficulties.
Bookman, 26:408.
- a De la Pasture, Mrs E. B.* The lonely lady of Grosvenor Square. Dutton \$1.50
- 6-41709 Pleasant story of a gentle and ingenuous Welsh girl, who through the death of an old aunt becomes the reluctant mistress of a great house in London.
Acad. 72:144; Ath. 1907, 1:192; Bookman, 25:181; Dial, 42:226; Nation, 84:291.
- a De Morgan, W. F.* Alice-for-short: a dichronism. Holt \$1.75
- 7-20515 The development, love affairs and mysterious family history of a little London waif, adopted into a rich middle class family. While not quite so successful, resembles *Joseph Vance* in leisurely geniality and lovable characterization.
Acad. 73:658; Ath. 1907, 2:10; Bookman, 25:519; Dial, 42:375; Nation, 84:522; Sat. R. 104:54; Spec. 99:96.
- b Duncan, Norman.* Cruise of the Shining Light. Harper \$1.50
- 7-15117 Delightfully human, whimsical story of a rough Newfoundland fisherman's tender care for an adopted boy, whom he rears in the combined light of the Psalms and Lord Chesterfield.
Ath. 1907, 2:547; Forum, 39:118; Independent, 63:101; Nation, 84:478; North Amer. R. 185:328.
- a Fraulein Schmidt and Mr Anstruther:* by the author of "Elizabeth and her German garden." Scribner \$1.50
- 7-21365 Letters from a piquant, brilliant German girl in Jena to a young Englishman, a renegade lover. Clever character sketches, frank comments on life and literature, and unfailing humor reveal a delightful personality.
Ath. 1907, 1:630; Dial, 43:65; Nation, 84:591; Spec. 98:763.
- Freeman, Mrs M. E. (Wilkins).* The fair Lavinia and others. Harper \$1.25
- 7-34778 Modern and 18th century stories, three of which, The pink shawls, The secret, and The gold, are in Mrs Freeman's earlier and more characteristic manner.
Nation, 86:39; Outlook, 87:745.
- Gale, Zona.* The loves of Pelleas and Etarre. Macmillan \$1.50
- 7-30832 Sentimental story, told with quaint, dainty humor, of two "young-old married folk" who have never ceased to be lovers and to love young lovers.
Nation, 86:38; N. Y. Times Sat. R. 12:380; Outlook, 87:622.

Gorki, Maxim, *pseud.* (A. M. Pieshkov). *Mother*.
Appleton \$1.50

7-16750 A middle-aged Russian peasant, brutalized by abuse, awakens to emotional and intelligent life through her efforts to understand and aid in her son's revolutionary activities.

A public which connects . . . Gorky with squalid realism and moral laxity should read this moving and human story. Hardly elsewhere has socialism spoken with a voice at once so deep and so gentle. *Nation*, 84:544.

Cath. World, 85:677; North Amer. R. 85:661; Putnam's, 3:111.

a Hall, E. C. *Aunt Jane of Kentucky*. Little \$1.50

7-12978 An old lady's reminiscences of her youth, full of quaint humor, wholesome sentiment and homely philosophy, giving a pleasant picture of rural life.

Cath. World, 85:688; Outlook, 86:117; Putnam's, 2:749.

c Harrison, Mrs M. St L. (Kingsley) "Lucas Malet,"
pseud. *The far horizon*. Dodd \$1.50

7-983 London story of a superannuated bank clerk's friendship with a fascinating actress. Interest lies in the character and spiritual development of the chivalrous and unworldly hero.

Bookman, 24:595; Cath. World, 85:538; Dial, 42:225; Nation, 84:39; N. Y. Times Sat. R. 12:202 (Madison Cawein); Putnam's, 2:183; Sat. R. 102:744; Spec. 97:937.

b Hawthorne, Julian, *ed.* *Library of the world's best mystery and detective stories*. 6v. Sold only in sets.
Review of Reviews \$3 n

8-35588 One hundred and one stories of mystery, magic and the supernatural, from American, English, Scotch, Irish, German, Scandinavian, Russian, French, Italian, Spanish and oriental sources and including extracts from personal memoirs and scientific papers explaining the wonders of modern magic and "psychic" manifestations. Mostly by well known authors, many translated for the first time.

c Howells, W. D. *Through the eye of the needle*.

Harper \$1.50

7-15545 The first part is a view of modern New York as seen by a traveler from the ideal commonwealth of Altruria; the second an account of Altruria as seen by the American wife whom he takes home with him and who has a difficult time adjusting her ideas to those of Altruria.

Nation, 84:434; North Amer. R. 186:127; Spec. 98:836.

b Lancaster, G. B. *The tracks we tread*.

Doubleday \$1.50

7-28459 Terse, vivid expression and a grim humor characterize this unconventional story of life on a New Zealand cattle ranch, where elemental passions predominate and love works its leavening influence.

Bookman, 27:102; Nation, 85:545.

c Laughlin, C. E. *Felicity: the making of a comédienne.* Scribner \$1.50

- 7-10619 Human and winsome story of a theatrical star. Pictures stage life without glamor or prejudice and shows the pathetic loneliness of publicity.
Atlantic, 100:133; Bookman, 25:284; Dial, 42:315; Nation, 84:291.

Le Blond, Mrs Aubrey. *Story of an Alpine winter.* Macmillan \$1.50

- 8-12971 As a story quite negligible but most interesting in its descriptions of winter sports in the Engadine Alps.
7-7196 In A. E. W. Mason's *Running water* (Century \$1.50) also, the dominating interest is high Alpine climbing and its influences on character, and this redeems a story not otherwise very successfully developed.
Le Blond, Sat. R. 105:52. Mason, Acad. 72:205; Ath. 1907, 1:349; Dial, 43:376; Outlook, 85:717.

Lincoln, J. C. *The "Old Home House."*

Barnes \$1.25

- 7-21534 Eleven amusing yarns of summer days and summer boarders on Cape Cod, told by Barzilla Wingate, longshore skipper.
Nation, 85:235.

Lynde, Francis. *Empire builders.*

Bobbs-Merrill \$1.50

- 7-26019 A slight love story scarcely interrupts the rapid action of this stirring tale of the financing and building of a Rocky mountain railroad through the grit, foresight and push of its young chief engineer.
Bookman, 26:164; Outlook, 87:45.

Martin, Mrs Helen (Riemensnyder). *Betrothal of Elypholate, and other tales of the Pennsylvania Dutch.* Century \$1.50

- 7-30437 Short stories humorously and sympathetically interpreting characteristic traits of the New Mennonites of Pennsylvania. Decidedly more interesting than Mrs Martin's longer stories.
N. Y. Times Sat. R. 12:676; Outlook, 87:450.

c Mason, A. E. W. *The broken road.* Scribner \$1.50

- 7-37552 An intense, swift-moving story of life in India, in which a young English engineer and an Indian prince, educated in England, are chief characters, and the building of a road across the northern frontier furnishes the principal incidents.

A. L. A. Booklist.

Ath. 1907, 2:682; Outlook, 87:827.

Montrésor, F. F. *The burning torch.* Dutton \$1.50

- N7-204 The "burning torch" is a young girl's fatal gift of second sight. A somewhat eerie supernaturalism is offset by quiet humor and interesting characterization.

Acad. 73:731; Ath. 1907, 1:786; Nation, 85:286; Putnam's, 3:239; Spec. 99:159.

Moody, W. S. The Pickwick ladle, and other collector's stories. Scribner \$1.50

- 7-35226 Six quietly humorous stories relating the experiences of a young married couple of limited means and excellent taste, in their search for antiques.
Nation, 84:523.

Mosenthal, S. H. Stories of Jewish home life. Jewish Pub. Soc. \$1.25

- 7-40796 Five stories of character development in girls or women, projected against a background of Jewish customs and traditions.
7-12639 *Simcon Eichelkatz* (Jewish Pub. Soc. \$1.50) by Ulrich Frank (pseud. for Frau Ulla Hirschfeld Wolff), translated from the German, contains two excellent studies in race temperament, almost without plot, the first emphasizing the older and the second the modern type of Judaism.
Mosenthal, N. Y. Times Sat. R. 13:206. - Frank, N. Y. Times Sat. R. 12:432.

Oxenham, John. The long road. Macmillan \$1.50

- 7-10620 Painful but restrained and inspiring story of Siberian exile. A young Russian, condemned to perpetual wandering by a tyrant official, is overwhelmed by the sorrows of his lot, but finds solace in the service of his fellows.
Acad. 72:345; Bookman, 25:501; Dial, 42:376; Nation, 84:314.

Page, T. N. Under the crust. Scribner \$1.50

- 7-37269 Six studies of human nature in story form which get at the real man and woman "under the crust" of convention, habit or pretense. Also a one act play of the Civil War.
Nation, 86:83; N. Y. Times Sat. R. 12:826; Outlook, 87:742.

a Parker, Sir Gilbert. The weavers: a tale of England and Egypt of fifty years ago. Harper \$1.50

- 7-30167 Egypt's picturesque cities and desert, an English Quaker town and London high life offer strong contrasts of background for the well drawn characters of a compelling tale of politics, intrigue and love. *A. L. A. Booklist*.
Acad. 73:116; Bookman, 26:169; Dial, 43:319; Nation, 85:306.

Porter, Mrs Gene Stratton. At the foot of the rainbow. Outing \$1.50

- 8-978 Story of Indiana country life, blending humor and pathos and pervaded by a breezy, out-of-doors atmosphere, in which a rough, lovable Scotchman and a dissipated Irishman and his wife are the only characters.
N. Y. Times Sat. R. 13:95.

Quaint courtships. (Harper's novelettes) Harper \$1

- 6-28455 Ten stories by Margaret Delard, Norman Duncan, Mary Wilkins Freeman, Elba W. Peattie, Annie D. Small and others. The series to which it belongs, edited by W. D. Howells and H. M. Alden, brings together much widely scattered good material.

- **Rideout, H. M.** The Siamese cat. McClure \$1.25
 7-15114 Narrates the lightning series of mysterious mishaps which follow the purchase of the Siamese cat by a young American traveling in the East with her maiden aunt. Combines humor, picturesque adventure and a spontaneous little romance.
 Nation, 84:544.
- Robins, Elizabeth,** "C. E. Raimond," *pseud.* Under the Southern Cross. Stokes \$1.50 n
 7-36093 A shipboard love affair between an impetuous Peruvian baron and a charming, self-possessed New Yorker. Piquant comedy with a genuinely pathetic note.
 Bookman, 27:104.
- Sherwood, M. P.** The Princess Pourquoi. Houghton \$1.50
 7-31285 Five stories presenting in allegory such social problems as the education of woman, the accumulation of wealth, etc. Very well written but limited in appeal. Reprinted from magazines.
 Nation, 85:474; N. Y. Times Sat. R. 12:661.
- Smith, F. H.** Romance of an old-fashioned gentleman. Scribner \$1.50
 7-31210 Charming story of an artist's high standards of honor, exemplified in his love and renunciation, and years later in his influence on the business career of a protégé.
 Nation, 85:446; N. Y. Times Sat. R. 12:764; Outlook, 87:496.
- Stewart, C. D.** Partners of Providence. Century \$1.50
 7-12003 Story of Missouri and Mississippi steamboat life, humorously told in boy language, and, like the river, running a long and devious course.
- Vachell, H. A.** Her son. Dodd \$1.50
 7-31481 Sacrificing her reputation, Dorothy Fairfax adopts and brings up as her own the illegitimate son of the lover she has dismissed but still loves. A consistent record of superlative self-sacrifice.
 Acad. 72:415; Ath. 1907, 1:501; Bookman, 26:278; Nation, 85:519; Spec. 98:721.
- Wallace, Dillon.** Ungava Bob: a winter's tale. Revell \$1.50
 7-29093 Adventures of a plucky 16 year old boy while fur hunting in Labrador. Author's recent explorations in country lend authority to descriptions of life, customs and scenery.
- Wharton, Mrs E. N. (Jones).** Fruit of the tree. Scribner \$1.50
 7-32842 Story of a young social reformer who thwarts his own happiness and that of the two women who love him by his implacable devotion to his ideals. Subtle, artistic and acutely analytical but lacking in geniality and personal appeal.
 Acad. 74:345; Bookman, 26:273; Dial, 43:317; Nation, 85:514, Spec. 99:1057.

Wiggin, Mrs K. D. (Smith) (Mrs Riggs). New chronicles of Rebecca. Houghton \$1.25

- 7-11587 The reader will welcome the reappearance of the clever, sensitive and appreciative child — Rebecca, and regret that in the last two of these 11 stories, she seems to be developing into an everyday young woman.

Ath. 1907, 2:179; Atlantic, 100:133; Bookman, 25:304; Nation, 84:362; Sat. R. 104:86; Spec. 98:1037.

Zangwill, Israel. Ghetto comedies. Macmillan \$1.50

- 7-15120 Studies of Jewish temperament in divers places and classes, from Russia to America and from Ghetto tailor and peddler to artist, musician and English M. P.; embodying sympathetic humor, certain knowledge and artistic realism.

Ath. 1907, 1:788; Bookman, 25:430; Nation, 84:478; Sat. R. 103:624; Spec. 98:677.

JUVENILE BOOKS

- 174 **Carruth, W. H.** Letters to American boys.

Amer. Unit. Ass'n 80c n

- 7-41094 Manly, unsentimental talks with boys on individual and civic duties, sport and choice of a career. Suggestive also for any one having relations with boys.

- 394 **a Stevenson, B. E. & Butler, Mrs E. S. comp.** Days and deeds: prose for children's reading and speaking.

Baker & T. \$1 n

- 7-36391 Supplements their *Days and deeds: poetry* with selections from a wide range of writers, on American holidays, special days, great Americans and the seasons.

- 398.2 **Buxton, E. M. Wilmot.** Stories of early England. (Children's favorite classics) Crowell 60c

- 6-22318 Hero tales and myths, pleasingly rendered from *Beowulf*, *Cynwulf and Cynherd*, the *Mabinogion*, *Fight of Brihtnoth*, *Saxon chronicle*, *Lay of Havelock*, etc., including a few old English poems translated by Stopford Brooke.

- 398.2 **Darton, F. J. H.** Wonder book of old romance.

Stokes \$1.50

- 8-35256 Thirteen tales, including William and the Werewolf, King Robert of Sicily, Sir Gawaine and the Green Knight, Guy of Warwick, Havelock the Dane, etc. 40 plates from drawings, and interesting initials.

- 398.2 **b Lang, Andrew.** Tales of Troy and Greece.

Longmans \$1.50 n

- 7-34175 Adventures of Greek heroes, Ulysses, Perseus and Theseus. In these stirring tales the atmosphere of the Homeric age, rich in color, downright in action, is recreated.

- 7-30639 Church's *Iliad for boys and girls* (Macmillan \$1.50) tells the story of Troy in simpler but equally unaffected style. Both are beautifully printed and delightfully illustrated, the latter in delicate colors.

Lang, Acad. 74:370; Ath. 1907, 1:514; Sat. R. 104, 7 Dec. '07 sup. p. 5; Spec. 99:713. Church, Ath. 1907, 2:514; Sat. R. 104, 7 Dec. '07 sup. p.5; Spec. 99:713.

- 398.2** **Marshall, H. E.** Stories of William Tell and his friends. (Told to the children ser.) Dutton 50c
 7-25666 Tells simply the brave legends surrounding the Swiss struggle for liberty. Eight colored illustrations.
- 398.2** **Pyle, Howard.** Story of Sir Launcelot and his companions. Scribner \$2.50 n
 7-34314 Uniform with his *King Arthur and his knights* and *Champions of the Round Table*. Like them follows Mallory in spirit and archaic language, altering some incidents to suit a children's version. Author's illustrations.
 Nation, 85:496.
- 398.2** **Wiggin, Mrs K. D. (Smith) & Smith, N. A. ed.** Magic casements: a second fairy book. (McClure's lib. of children's classics) McClure \$1.50
 7-39995 Fairy tales from Scandinavian, French, Italian, Russian, African, Japanese, English and other sources.
 7-35196 Ernest Rhys's *Fairy gold*, published in attractive, illustrated form at \$2.50 and more modestly in Everyman's lib. (Dutton 50c), is made up chiefly of old English tales and romances.
- 523** **Mitton, G. E.** Children's book of stars. (Color bk ser.) (Black 6/) Macmillan \$2. n
 W7-170 Comes nearer success than any predecessor in an attempt to make astronomical facts clear and interesting to children. Uncommonly well illustrated.
 Spec. 99:638.
- 537** **a Adams, J. H.** Harper's electricity book for boys. (Harper's practical bks for boys) Harper \$1.75
 7-37737 Clear directions for manufacturing everyday electrical appliances with homemade apparatus at small cost. Includes chapter explaining electric light, heat, power and traction and a dictionary of electrical terms. Illustrated by drawings.
 7-33979 Will be used by somewhat younger boys than Tudor Jenks's *Electricity for young people* (Stokes \$1.50 n), an historical account of the development of knowledge and control of electricity. E. J. Houston's *Boy electrician* (Lippincott \$1.50) gives much authoritative information in a story so wooden and perfunctory that it is difficult not to condemn without qualification, but at least one boy has been delighted with it.
 7-36998 Adams, Elec. World, 50:1128; Nation, 85:519. Jenks, Nation, 85:519.
- 598.2** **c Wright, Mrs Mabel (Osgood), "Barbara," pseud.** Gray Lady and the birds: stories of the bird year for home and school. Macmillan \$1.75 n
 7-38237 A thread of story binds attractively much interesting and instructive matter about birds. 48 excellent halftones, 12 being colored.
 7-7517 Neltie Blanchan's *Birds that every child should know: the East* (Doubleday \$1.20 n) describes the appearance, nest, eggs and songs of our eastern birds and photographs them at home.

- 613** *c* **Jewett, F. G.** Good health. (Gulick hygiene ser. bk 1) Ginn 50c n
- 6-39010** Readable and sensible little book on personal hygiene, designed for elementary textbook. Discusses cleanliness, ventilation, care of eyes, ears, finger nails, hair, teeth, skin, importance of exercise, correct breathing, sleep, etc.
- 614** ——— Town and city. (Gulick hygiene ser. bk 3) Ginn 60c n
- 7-3113** Points out the physical evils attendant on crowded town life, shows how city departments are trying to meet them and encourages children to do their part in the good work.
Lib. Jour. 33:139.
- 614.84** *a* **Downes, A. M.** Fire fighters and their pets. Harper \$1.50
- 7-38206** Interesting accounts of heroism, perils, discipline and pastimes of New York firemen, descriptions of fire-fighting apparatus and anecdotes of engine-house pets. By secretary of New York fire department. Binding flimsy and inartistic but 85 halftones good.
- 621.13** **Howden, J. R.** Boys' book of locomotives. McClure \$2
- W7-215** For those who are intelligently interested in machinery and want to know "how" and "why." Probably few boys under 18 will fully understand the explanations of principles and construction, but over 100 photographs will attract younger enthusiasts.
Nation, 85:520.
- 630** **Keffer, C. A.** Nature studies on the farm: soils and plants. (Eclectic readings) Amer. Bk Co. 40c
- 7-8528** Simple lessons on the way plants grow. The following is quoted from a farmer: "A good book to put in the hands of a child to open his eyes to what is going on in the nature world around him. To be commended for what it leaves out as well as for what it puts in."
- 793** **Pearson, A. C. ed.** Twentieth century standard puzzle book. 3 pt in 1 v. (Routledge 3/6) Dutton \$1.50
- 8-35591** Contains magic squares, tricks, charades, conundrums, optical illusions, freaks of figures, chess cameos, curious calculations, anagrams, palindromes, etc. with solutions.
- 7-34781** E. H. Glover's "*Dame Curtsey's*" book of novel entertainments for every day in the year (McClurg \$1 n) is arranged by months and furnishes suggestions for holidays, special days and social affairs in home, church and club. *What shall we do now?* (Stokes \$1.50) "by Dorothy Canfield and others" is an Americanized reprint of an English book with the same title by E. V. and Elizabeth Lucas, Grant Richards, 1900. The material in Carolyn Wells's *Rainy day diversions* (Moffat \$1 n) is divided into three parts: pt 1, a description, in story form, of tricks, games and indoor amusements; pt 2, suggestions for celebrating holidays; pt 3, two short Christmas plays.
Canfield, Nation, 85:519. Wells, Nation, 85:519.

- 796 Adams, J. H.** Harper's outdoor book for boys.
(Harper's practical bks for boys) Harper \$1.75
7-21249 Simple, practical directions for making all sorts of things for outdoor enjoyment — windmills, aeroplanes, ice boats, skees, tree huts, equipment for camp life, trapping, hunting and fishing. Illustrated with working diagrams.
Nation, 85:100.
- 821.08 Lucas, E. V. ed.** Another book of verses for children.
Macmillan \$1.50 n
7-32337 Admirable selections, chosen partly with view to reading aloud, a large proportion not being found in other children's anthologies. They range from Shakspeare, Blake, Tennyson to modern nonsense rhymes. Attractively illustrated.
W7-200 Attention should be called to Louey Chisholm's compilation *The golden staircase* (Putnam \$2.50 n; Jack 7/6 n) a charmingly printed, bound and illustrated quarto in which selections are so arranged that the child may make a progress from simple verse to more mature poetry. *Pinafore palace*, compiled by Kate Douglas Wiggin and Nora Archibald Smith (McClure \$1.50 398.8), is a collection for the youngest children similar in arrangement and execution to their *Posy ring*.
Chisholm, Ath. 1906, 2:827; Nation, 85:495; Outlook, 87:358; Spec. 98:627. Wiggin & Smith, Nation, 85:495.
- 822.33 Shakspeare, William.** Midsummer-night's dream for young people. (Dandelion ser.) Stokes \$1.50
7-27351 Introduced by a little story about the play's first production before Queen Elizabeth. Adapted from Cambridge text, with graceful, imaginative colored illustrations and black and white decorations by Lucy Fitch Perkins.
- 910 Bonawitz, George & Coleman, Helen.** Little travelers around the world: visits to people of other lands.
Barnes \$1
7-37551 Useful in children's room for its 24 attractive halftone plates and many drawings in text, illustrating scenery and customs. Letterpress, plainly written to fit pictures, has no further value.
- 914.92 Jungman, Beatrix.** Holland. (Peeps at many lands ser.) (Black 1/6 n) Macmillan 75c n
W7-234 Fourteen descriptive sketches and 12 colored pictures introducing the English child to the life, history and folklore of Holland. Text adapted and plates reprinted from *Holland*, written and illustrated by Beatrix and Nico Jungman (Black 20/). The colored illustrations for the other books of this attractive but unsubstantially bound series (Macmillan 75c n ea.) are taken from beautiful and expensive books of travel published by Black, the text for *Italy*, *France*, *India* and *Japan* being written by John Finnemore, and for *Scotland* by Elizabeth Grierson.
- 917.2 Plummer, M. W.** Roy and Ray in Mexico.
Holt \$1.75 n
7-19788 Two wide-awake children, with their parents, visit modern cities and ancient ruins, learn much of customs and history, meet President Diaz and compare things Mexican and American. Map, 16 halftone plates and Mexican songs with music. Useful as a travel guide and helpful to teachers and school children.
N. Y. Times Sat. R. 12:618.

- 917.3 **Brigham, A. P.** From trail to railway through the Appalachians. Ginn 50c
- 7-8511 A combination of history and geography, describing the development of waterways and railways along the old routes by which population and commerce moved westward in pioneer days.

JUVENILE BIOGRAPHY

- Barton, Clara.** Story of my childhood. Baker & T. 50c n
- 7-35389 Addressed to children and told very simply and directly, but not "written down." Will please adults and those children who already know something about Miss Barton.
- Joan of Arc.* **Boutet de Monvel, L. M.** Joan of Arc. New ed. Century \$3 n
- W8-2 This beautiful book, some years out of print, is well fitted to inspire in children both a love of art and an enthusiastic interest in a picturesque historic figure.
- c Steedman, Amy.* Knights of art: stories of the early life of the great Italian masters, told for children. (Jack 6/n) Jacobs \$2 n
- 8-35590 Best book on art for children (1907). Contains sketches of 18 Italian painters from Giotto to Paul Veronese, based on Vasari and attractively written. 16 color and eight black and white reproductions.
- 8-13746 Lady Tennant in *The children and the pictures* (Macmillan \$1.50) has provided imaginary stories about the subjects of 21 paintings by famous English artists, which may serve to interest some children in the excellent reproductions in color.
- Steedman, Ath. 1907, 2:726. Tennant, Acad. 73:213; Spec. 99:903.

JUVENILE FICTION

- b Aanrud, Hans.* Lisbeth Longfrock. ("Once upon a time" ser.) Ginn 65c
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- N. Y. Times Sat. R. 12:493.
- c Altsheler, J. A.* Young trailers: a story of early Kentucky. Appleton \$1.50
- 7-29578 Above the average story for boys in its faithful descriptions of out-of-door life and pioneer conditions in Kentucky.
- Outlook, 87:311.
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- c Garland, Hamlin.** The long trail: a story of the Northwest wilderness. Harper \$1.25
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 The blind. O. L. Mann, '02
 History of latter half of 18th century: reading list. E. S. Wade, '02
 Industrial development of the U. S.; select list. B. A. Whittemore, '02
 Pipe organs and organists. Josephine Taber, '02
 Books by Canadian authors since 1867. W. M. Hepburn, '03
 Books in the 200's for a 5000 v. library. E. K. Corwin, '03
 Classified fiction: select lists. J. M. Whittlesey, '03
 England and Wales: reading list. A. E. Draper, '03
 Germany: select list. E. R. Seligsberg, '03
 Holidays: select list. R. M. McCurdy, '03
 Illustrative material for nature study in primary schools. F. T. Blunt, '03
 Maryland history since the Revolution. H. M. Thompson, '03
 Higher commercial education. C. M. Houghton, '04
 Niagara Falls. Mrs A. H. (Rodgers) Wright, '04
 Pre-Raphaelitism. E. B. Ketchum, '04
 Roman private life. Ernestine Rose, '04
 Roosevelt: partial bibliography. E. L. Pearson, '04
 George John Romanes. M. L. Gilson, '05
 Radio-activity and radium. L. M. Solis-Cohen, '05
 Victor Hugo. B. I. Bennett, '05
 Books and pamphlets printed in and relating to Northampton, Mass. F. E. Walter, '06
 Old Northwest: reading list. F. L. D. Goodrich, '06

Education Department Bulletin

Published fortnightly by the University of the State of New York

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No. 431

ALBANY, N. Y.

SEPTEMBER 15, 1908

PROCEEDINGS OF THE 12th ANNUAL MEETING OF THE NEW YORK STATE SCIENCE TEACHERS ASSOCIATION

Held at Cornell University, Ithaca, N. Y., December 27-28, 1907

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ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1908

H4237-78-1908

STATE OF NEW YORK
EDUCATION DEPARTMENT

Regents of the University

With years when terms expire

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1917	ST CLAIR MCKELWAY M.A. LL.D. <i>Vice Chancellor</i>	-	Brooklyn
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1914	PLINY T. SEXTON LL.B. LL.D. - - - - -	-	Palmyra
1912	T. GUILFORD SMITH M.A. C.E. LL.D. - - -	-	Buffalo
1918	WILLIAM NOTTINGHAM M.A. Ph.D. LL.D. - -	-	Syracuse
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1915	ALBERT VANDER VEER M.D. M.A. Ph.D. LL.D. -	-	Albany
1911	EDWARD LAUTERBACH M.A. LL.D. - - - - -	-	New York
1909	EUGENE A. PHILBIN LL.B. LL.D. - - - - -	-	New York
1916	LUCIAN L. SHEDDEN LL.B. LL.D. - - - - -	-	Plattsburg

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Statistics, HIRAM C. CASE

Trades Schools, ARTHUR D. DEAN B.S.

Visual Instruction, DeLANCEY M. ELLIS

Education Department Bulletin

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NO. 431

ALBANY, N. Y.

SEPTEMBER 15, 1908

PROCEEDINGS OF THE 12th ANNUAL MEETING OF THE NEW YORK STATE SCIENCE TEACHERS ASSOCIATION

Held at Cornell University, Ithaca, N. Y., December 27-28, 1907

OFFICERS 1907

President, J. S. SHEARER, Cornell University, Ithaca

Vice President, E. D. ROE, Syracuse University

Secretary-Treasurer, J. E. STANNARD, Adelphi Academy, Brooklyn

EXECUTIVE COUNCIL

Terms expire 1910

G. M. TURNER, Masten Park High School, Buffalo

T. C. HOPKINS, Syracuse University

CHARLES NEWELL COBB, State Education Department, Albany

Terms expire 1909

A. P. BRIGHAM, Colgate University, Hamilton

C. E. HARRIS, East High School, Rochester

HOWARD LYON, Oneonta Normal School

Terms expire 1908

L. V. CASE, Washington Irving High School, Tarrytown

W. T. MORREY, Morris High School, New York city

J. S. SHEARER, Cornell University, Ithaca

Terms expire 1907

A. W. FARNHAM, Oswego Normal School

F. L. BRYANT, Erasmus Hall High School, Brooklyn

J. E. KIRKWOOD, Syracuse University

COMMITTEES**Committee on federation**

JOHN F. WOODHULL, Teachers College, New York city, *Chairman*
GEORGE M. TURNER, Masten Park High School, Buffalo
HOWARD LYON, Oneonta Normal School

Committee on new move among physics teachers

Under charge of section A

JOHN F. WOODHULL, Teachers College, New York city, *Chairman*
J. S. SHEARER, Cornell University, Ithaca
O. C. KENYON, Syracuse High School
E. S. WETMORE, State Normal College, Albany
L. E. JENKS, Ogdensburg High School

Committee on biology in secondary schools

J. E. PEABODY, Morris High School, New York city, *Chairman*
W. M. SMALLWOOD, Syracuse University
GEORGE F. ATKINSON, Cornell University

Committee to aid in the biological survey project

CHARLES W. DODGE, University of Rochester, *Chairman*
C. W. HARGITT, Syracuse University
C. W. HAHN, High School of Commerce, New York city

Local committee on arrangements

J. S. SHEARER, *Chairman*; R. S. TARR, L. M. DENNIS, H. REIS,
E. BLAKER, B. F. KINGSBURY, H. D. REED, E. J. DURAND,
C. H. TUCK, A. E. WELLS

SUMMARY OF SESSIONS

FRIDAY MORNING, DECEMBER 27

Council meeting. Room 130, Rockefeller Hall

General meeting. Lecture room A, Rockefeller Hall

Address of welcome, PRESIDENT SCHURMAN

Introduction of *President-elect* SHEARER by retiring *President* WOODHULL

Section meetings

Section A — Physics and chemistry. Room B, Rockefeller Hall

1 The Measurement of Very High and of Very Low Temperatures

J. S. SHEARER, Cornell University

2 Inspection of Laboratories of Rockefeller Hall, to see various laboratory experiments asked for by teachers

Under direction of ERNEST BLAKER, Cornell University

3 Some Suggestions Regarding the Teaching of Elementary Electricity

R. C. GIBBS, Cornell University

4 Some Experiments Illustrating Wave Motion and Methods of Projection

C. W. WAGGONER and E. C. CRITTENDEN, Cornell University

Section B — Biology. Amphitheater, Stimson Hall. ESTHER F.

BYRNES, Girls High School, Brooklyn, *Chairman*

1 Factors that Make for Success in the Teaching of Biology in our High Schools

H. H. WHETZEL, Cornell University

2 Aim and Method in Secondary Biology

MARTHA F. GODDARD, Morris High School, New York city

3 Some By-Products of Biology Teaching

BENJAMIN C. GRUENBERG, DeWitt Clinton High School, New York city

4 Discussion of questions sent, for the question box

5 Communications read by the secretary

Section C — Earth science. Geological lecture room, McGraw Hall. JENNIE T. MARTIN, Business High School, Washington,

D. C., *Chairman*

- 1 The Use of a Wet Laboratory in Physiography Teaching, illustrated by lantern slides

OSCAR D. VON ENGELN, Cornell University

- 2 Discussion: Laboratory Work in Physiography, its Advantages and Dangers

MARY GERTRUDE SULLIVAN, Masten Park High School, Buffalo, N. Y.

FRIDAY AFTERNOON, DECEMBER 27

Luncheon in Sage College

Section A — Physics and Chemistry. Chemical laboratory lecture room, Morse Hall

- 1 Demonstrations

Given by L. M. DENNIS

a Some Illustrative Experiments in Elementary General Chemistry

b The Electric Furnace and Some of its Products

c Preparation of Molten Iron for Welding by Use of Thermite

- 2 Inspection of the Chemical Laboratories

Under direction of L. M. DENNIS, Cornell University

Section B — Biology. Botanical lecture room, Sage College.

ESTHER F. BYRNES, Girls High School, Brooklyn, *Chairman*

- 1 The Work of a Children's Museum, illustrated by stereopticon slides

ANNA BILLINGS GALLUP, Brooklyn Institute of Arts and Sciences

- 2 Inspection of Apparatus used in the Department of Botany

Conducted by DR E. J. DURAND, Cornell University

Section C — Earth science. Geological lecture room, McGraw Hall. JENNIE T. MARTIN, Business High School, Washington, D. C., *Chairman*

Examination of physiographic and geologic laboratories of Cornell University

Street car excursion: Physiographic Features of the Ithaca Region

Led by OSCAR D. VON ENGELN, Cornell University

FRIDAY EVENING, DECEMBER 27

General meeting. Lecture room A, Rockefeller Hall

- 1 The Development of Atomic Theories

L. M. DENNIS, Cornell University

2 Electrical Oscillations

J. S. SHEARER, Cornell University

Several experiments in connection with these two informal talks were kept in operation after the session for comment and questions. Reception by President and Mrs Schurman at the President's House, 41 East Avenue, Campus

SATURDAY MORNING, DECEMBER 23**Section meetings**

Election of section officers and miscellaneous business

Section A — Physics and chemistry**1 Exhibition of Liquid Air Plant in Operation**

F. K. RICHTMYER, Cornell University

2 Inspection of Dynamo Laboratory

F. BEDELL, Cornell University

3 Photography Laboratory

G. S. MOLER, Cornell University

4 Exhibit of Lantern Slides prepared by the Lumière Color Photography Process

DR E. R. VON NARDROFF, Erasmus Hall High School, Brooklyn

5 Talk on Wireless Telephony

C. D. CHILDS, Colgate University, Hamilton, N. Y.

6 The Study of Science by Young People

WILLIAM S. FRANKLIN, Lehigh University, South Bethlehem, Pa.

Section B — Biology. Room 5, McGraw Hall. ESTHER F. BYRNES, Girls High School, Brooklyn, *Chairman***1 The Educational Uses of Sharks and Rays, especially the Acanth (Squalus Acanthias, "horned dogfish")**

BURT G. WILDER, Cornell University

2 First Year Biology in New York City

ZILLAH HEIDENHEIM, Curtis High School, Staten Island

3 Experimental Work in Biology

CYRUS A. KING, Erasmus Hall High School, Brooklyn

4 Inspection of Department of Vertebrate Zoology, Cornell University**Section C — Earth science. Geological lecture room, McGraw Hall. JENNIE T. MARTIN, Business High School, Washington, D. C., *Chairman***

- 1 How to make relief models of small areas, with an explanation of a peculiar and interesting glacial valley
T. C. HOPKINS, Syracuse University
- 2 Power Questions and their Value
JENNIE T. MARTIN, Business High School, Washington, D. C.
- 3 Brief contributions from members, including new laboratory exercises, teaching devices, results of field investigations, etc.

Council meeting. Room 130, Rockefeller Hall

General meeting. Room A, Rockefeller Hall

- 1 Report of treasurer
 - 2 Report of auditing committee
 - 3 Report of nominating committee, election of officers, announcement of place of next meeting
 - 4 Necrology
 - 5 Reports of standing committees and delegates
 - 6 Miscellaneous business
- Address: The Outlook of Science Teaching
L. H. BAILEY, Cornell University

SATURDAY AFTERNOON, DECEMBER 28

Luncheon, Sage College

General meeting. Room 2, Morse Hall

The Purification of Water

E. M. CHAMOT, Cornell University

Followed by a visit to the Carnegie filtration plant on the Campus.

Other points of interest visited were the shops and laboratories of Sibley College and of the College of Civil Engineering, the power plant in the gorge, an example of small flow, high pressure hydraulic system, the Medical College, etc.

SUMMARY OF ACTION

Treasurer's report

Summary as per books and vouchers on file for year ending December 28, 1907

Receipts

Dec. 27, 1906 Balance on hand.....	\$148 09
Dec. 28, 1907 Dues to date.....	101 ..
Total.....	\$249 09

Expenditures

Dec. 28, 1907 Total to date.....	\$101 35
Dec. 28, 1907 Balance on hand.....	147 74
	\$249 09

Auditing committee. The auditing committee has examined the report of the treasurer of the New York State Science Teachers Association and finds it to be correct.

O. C. KENYON }
I. P. BISHOP } *Committee*

December 28, 1907

Report accepted

Nominating committee. The nominating committee made the following nominations: *President*, O. C. KENYON, Syracuse High School; *vice president*, W. M. SMALLWOOD, Syracuse University; *secretary-treasurer*, E. R. SMITH, Syracuse High School

For members of the council (term to expire 1911)

E. R. VON NARDROFF, Erasmus Hall High School, Brooklyn

C. B. ROBERTSON, Cortland Normal School

M. A. BIGELOW, Teachers College, New York

Motion was made and carried that the secretary cast the unanimous ballot of the association for those nominated.

Place of meeting

Syracuse was named as the next place of meeting.

Necrology

R. J. KITTREDGE, Erie, Pa. died November 1907.

Report of committees

The committee on Biological Survey reported progress and was continued.

No reports from other committees. Their work is to extend through a number of years so all committees were continued.

J. E. Peabody, Morris High School, New York, was released (upon request) from the chairmanship of the committee on biology. W. M. Smallwood, Syracuse University, was made chairman and Miss Esther Byrnes of Girls High School, Brooklyn, was added to the committee.

Section officers for 1908

Section A—Physics and chemistry

Chairman and secretary to be chosen by the new president

Section B—Biology

Chairman, L. S. HAWKINS, Cortland Normal School

Section C—Earth science

Chairman and secretary to be chosen by the new president

Vote of thanks. A vote of thanks was extended to Cornell University for its hospitality.

SECTION MEETINGS

Friday morning, December 27

Section A — PHYSICS AND CHEMISTRY

THE MEASUREMENT OF VERY HIGH AND OF VERY LOW TEMPERATURES

BY J. S. SHEARER, CORNELL UNIVERSITY

All comparisons of temperatures depend finally on the recurrence of some convenient physical state of phenomena which depends on thermal condition. Experience shows that the volume of a fixed amount of liquid returns to the same value when, after changes in temperature, it is again brought to its initial condition as regards temperature.

While change of volume of liquids or the change of pressure and volume of a gas are the physical properties more commonly used for temperature comparisons they are by no means the only ones now in practical use for this purpose. We may use any physical property which varies with temperature in order to make such measurements. Among the most convenient may be mentioned the following: change in electrical resistance, thermal electro-motive force, production of luminous radiation, thermal radiation, etc. None of these may be applied at all temperatures and their respective limitations may be briefly noted.

Liquid thermometers are limited by the melting and boiling points of the liquid used. Alcohol, for example, boils at a comparatively low temperature and freezes only in extreme cold, yet it becomes viscous long before solidification and is therefore not very useful as a thermometric fluid. Mercury freezes at about 40°C . and by increasing the pressure to which it is subjected and using quartz instead of glass tubes temperatures of 700°C . may be indicated. For extreme low temperatures petroleum ether may be used down to 190°C . for approximate measurement.

The gas thermometer while inconvenient in use has a range from the lowest temperature yet attained to about 1100°C ., the upper limit being determined by our inability to secure suitable containers for the gas. It is also the final standard for temperature measurements and is used in the standardization of all accurate thermometers.

The electric resistance thermometer may be used from about 200° to 1000°C . The relation between change of temperature and change in resistance is decidedly modified below 200° , and even metals which do not melt at, or below, 1000°C . begin to evaporate at that point and are not reliable because of decrease of cross-section.

The thermojunction has a range from about the lowest known to about 1500°C . by using very refractory metals like platinum and some of its alloys.

No thermometer yet devised of the types mentioned exceeds the range of the thermocouple and yet much higher temperatures must be measured daily in the control of modern manufacturing processes. To meet these needs there have been developed several types of pyrometers as they are called which give fairly consistent results for temperatures between about 700° and 3600° , i. e. from a dull red heat to the temperature of the electric arc. These instruments all depend on the laws of radiation, which are applied in various ways to accomplish the result.

The simplest is the Morse thermogage which may be illustrated by heating a wire by an electric current and holding it just in front of a red hot plate of metal. If the wire is cooler than the plate it will appear as a dark line on a bright background while if hotter the reverse will be the case. When the wire is practically invisible its temperature is very close to that of the plate. By using an incandescent lamp instead of the wire and a suitable optical arrangement this becomes a practical instrument of certain ranges especially those used in the manufacture of steel.

The Féry pyrometer may be illustrated by using a hot metal ball, a concave mirror and a thermopile. When the image of the ball is formed on the pile an indication is given which is in proportion to the temperature of the ball. Other instruments use the light from the hot body as compared with that from a standard source.

The radiation pyrometer has the great advantage of avoiding contact with the hot body and as no part is ever heated to any high temperature they are not likely to be damaged. One point should be kept in mind, however, that the radiation from a body does not depend exclusively on its temperature but also on the nature of its surface, so that calibrations are made in terms of an ideal arrangement termed a "black body" and the deviation from this is to be determined in any particular case.

INSPECTION OF LABORATORIES OF ROCKEFELLER HALL

UNDER DIRECTION OF ERNEST BLAKER

During the Ithaca meeting of the New York State Science Teachers Association December 27 and 28, 1907, the practice laboratories of the department of physics were open at any time for inspection by those interested. Eight members of the instructing staff were present to act as guides and to show such apparatus and experiments as were asked for in communications sent in to the president of the association.

Some experiments in wave motion, sound and lantern projection were shown in the section meetings which are outlined elsewhere. In the practice laboratories experiments were shown supplementing those just mentioned. In wave motion a heavy, soft copper spiral loosely coiled and suspended with its axis horizontal by long strings fastened to a horizontal support and the individual turns, was used to show longitudinal compressional waves and stationary waves. Melde's experiment was operated with two strings whose tension was regulated to give vibrating segments of equal length, one string being stretched parallel to the axis of the fork and the other perpendicular to the axis both being in the plane of the prongs. Kundt's experiment was demonstrated using an improved form of apparatus with powdered quartz in the tube. The ordinary forms of sonometers were also shown.

A 12 foot concave Rowland reflection diffraction grating was used to show the spectrum produced by a Cooper-Hewitt mercury lamp. Diffraction spectra were also produced by means of transmission gratings. The prismatic spark spectrum of lead was shown using a heavy flint glass prism. Interference bands produced by the Michelson interferometer using sodium light and the rotation of the plate of polarization in a magnetic field completed the regular exhibit in light.

In heat, apparatus was shown for finding Joules' equivalent by the electrical and mechanical method, for comparing thermometers and measuring temperatures by means of the platinum resistance thermometer, and for finding specific heat by Joly's steam calorimeter.

In electricity and magnetism a few of the pieces of apparatus and experiments shown are noted below: Magnetometers, quadrant electrometer, sensitive galvanometer, tangent and D'Arsonval

galvanometers for current, quantity and potential measurements, portable d'Arsonvals used for zero methods; different types of wheatstone bridges, the Carey-Foster bridge, and three styles of slidewire bridges.

A device for producing an alternating E. M. F. of high frequency but low voltage for use in measuring the resistance of electrolytes was in operation. The heating effect and consequent change of resistance of the electrolyte is practically eliminated by using this apparatus. The same apparatus was also used in the experiment on comparing the capacity of condensers by the bridge method. The pitch of the tone emitted may be regulated to suit the experimenter within quite wide limits.

Two small motor generator sets were in operation. One was made up of a $\frac{1}{2}$ hp. direct current motor directly connected to a two phase generator which in turn was used to drive a squirrel cage induction armature. The effect of the rotating field in this case was also shown by using light weight conductors in it which were easily rotated. The other motor generator set was made up of a $\frac{1}{2}$ hp. single phase inductor motor driving by means of a belt a 20 volt direct current generator which was used to supply current for various experiments including electrolysis.

The general photomotry laboratory is connected with the practice laboratories and in this division various photometers and light sources were exhibited.

In addition to the general exhibit outlined above, one morning was devoted to special demonstrations. The liquid air plant, the joint property of the departments of chemistry and physics, was operated under the direction of Mr F. K. Richtmyer who explained the operation in detail. Mr Richtmyer discussed the properties of liquid air, its composition as it aged and outlined its effects on the properties of various substances, and its usefulness in scientific research.

Following the liquid air demonstration Frederick Bedell assisted by C. A. Pierce conducted the visitors through the dynamo and alternating current laboratories of the department of physics where many interesting direct and alternating current phenomena were shown. These laboratories are used especially for research work and the general instruction of students in science.

In the department of physics there has been developed by G. S. Moler a photographic laboratory where instruction is given

in the ordinary photographic processes but it is more especially designed to prepare students for the use of photography in scientific work. This laboratory, which was the last visited, occupied the whole of the third floor in the north wing and a suite of rooms in the central section of the building. Mr Moler conducted the guests through this laboratory and explained the arrangement of rooms and the facilities of his department.

**SOME SUGGESTIONS REGARDING THE TEACHING OF ELEMENTARY
ELECTRICITY**

BY R. C. GIBBS, CORNELL UNIVERSITY

The method of presenting the subject of electricity will depend to a large extent upon what topics in physics have been previously studied. Let us suppose then the student has a fairly good knowledge of the principles of elementary mechanics, heat and magnetism. In magnetism let us assume that he knows the magnetic effects of current and the elementary laws connected therewith.

Granting this preparation we may at once begin the study of the laws of electric charges, first considering them as static and secondly as moving charges i. e. current electricity. The crucial point of the whole subject lies in getting the student to see the identity of the two kinds of electricity. He must be brought to realize that if a charge of electricity developed by whatever means, whether frictional, chemical, thermal, or inductive (e. g. as in a dynamo) is connected by a conductor to a place of lower potential, a current will result.

Experiments which demonstrate this identity include, among others, the testing for fall of potential through a resistance of several incandescent lamps in series in a 500 volt circuit, by means of an electroscope; the indication of current by means of a galvanometer when a condenser is charged from an electrostatic machine; the indication of current by means of a sensitive galvanometer when the armatures of a charged condenser placed on an insulated support are alternately discharged through the body. Other experiments depending upon the magnetic effects of current may be used to establish still further this identity.

In fixing in the mind of the student the relations between electric quantities much may be gained by comparing them step by step with the analogous phenomena which occur in a system of water pipes. Resistance, potential, capacity and several other terms all have their water analogue. Of course the analogy is not complete in several details, e. g. in the water system there is nothing corresponding to the magnetic field which surrounds a conductor carrying a current. The question of the capacity of a condenser, so often troublesome because of the common meaning attached to the term, may be quite accurately illustrated by considering the amount of air which can be forced into an elastic bag in order to produce a certain pressure.

Although the electric current might be measured more or less accurately by any one of its effects, viz, magnetic, chemical, thermal, or physiological, yet the first affords the most direct method of procedure because of the simple proportionality between the intensity of magnetic effects and that of current. This effect is independent of the size and nature of the conductors.

Among the quantities to be measured or computed in connection with electricity, that of the amount of work done, or energy consumed in any part of a circuit is generally troublesome. This is often due to the failure on the part of the student to understand or on the part of the teacher to present correctly the fundamental notion of potential. As soon as the student thoroughly grasps the idea that potential is something which will cause electric charge to move from one point of a conductor to another when for any reason the potential or pressure at the second point is less than that of the first, he has gone a long way toward clearing up what would otherwise be a more or less hazy conception of the whole subject of energy relations. Remembering that potential difference between two points is measured by the amount of work done in carrying unit charge from one point to the other, it is not difficult to see that if more charge were carried between the same points or the same charge between two points having a greater difference of potential a proportionally greater amount of work would be done.

Without going into detail it may be sufficient to call attention to the fact that the solution of Ohm's Law problems by mere substitution in a formula is worse than useless. An understanding of the principles underlying the formula referred to, together with a knowledge of its limitations, is essential.

Another topic which should receive considerable attention in the study of electricity is that of induced E. M. F. There are several other minor topics which should not be entirely omitted such as, electrolysis, passage of electricity through gases, and high frequency oscillations. The main object of this paper, however, has been to emphasize the importance of teaching the identity of electrostatic and current electricity, to suggest the expediency of using some analogy which will appeal to everyday experience, to point out the necessity of paying special attention to the fundamental notion of potential, and to discourage the mechanical method of solving problems by mere substitution in formulae of whose meaning and limitations the student has little or no idea and of which practice the Ohm's Law problems are glaring examples.



SOME EXPERIMENTS ILLUSTRATING WAVE MOTION AND METHODS OF PROJECTION

BY C. W. WAGGONER & E. C. CRITTENDEN, CORNELL UNIVERSITY

In response to requests for experiments in wave motion a few pieces of homemade apparatus were exhibited. Transmission of waves at a speed slow enough for convenient observation is shown by a piece of steel tape loaded with transverse sticks at intervals of a few inches and hung by one end from a suitable support. The lower end is left hanging free, so that reflection is shown with change of phase at the upper (fixed) end and without change of phase at the lower end. This device can be used also to show the passage of wave trains through one another. Additional weighting of a part of the tape makes it a "denser medium," for example by binding additional sticks upon those of the upper end we get partial reflection and partial transmission of the waves.

Standing waves can be readily shown in several ways. Good effects are obtained with a cord, one end of which is whirled by an eccentric cam on a small motor, while the other end is passed over a pulley and held by suspended weights. This affords a means of regulating the tension; the frequency can be readily altered by control of the motor; the effect of variation in mass of the string can be shown by using a light and a heavy cord in series. Polarization of the waves along the cord can be produced by a slip placed at an antinode, and a second slit furnishes an excellent analogy for the analyzer. Two details in the design exhibition of this apparatus are perhaps worth mentioning: first, the eccentric cam should have a swivel joint with a harness to prevent twisting of the cord; second, the cord can be made clearly visible by darkening the room and setting a lantern so as to throw a beam of light along the cord.

Another piece of apparatus can be made out of a section of galvanized iron conductor pipe 3 or 4 inches in diameter and 10 to 15 feet long. Close the ends, one by a sliding plug and the other by a piece of stretched rubber dam. Provide an inlet for coal gas, and along one side of the pipe drill a series of small holes all of the same size at intervals of about an inch. The gas jets thus made are lighted, giving a uniform row of flames. If then a continuous and fairly intense sound is produced near the rubber membrane and

the sliding plug is adjusted so as to tune the pipe to this sound, the nodes and antinodes in the pipe will be distinctly shown by the variation in height and color of the flames. The gas pressure in the pipe must be rather small.

Beautiful systems of standing waves are easily produced on the surface of mercury. A steady system can be obtained by running a motor on the table or by putting into the mercury one end of a wire which is connected to an electrically driven tuning fork. Instructive variations are made by using vessels of various shapes, such as circular, elliptical, or triangular. Two vibrating wires as sources produce systems of waves in which the lines of destructive interference are plainly marked. In the case of the elliptical vessel, if a vibrating wire is put near one focus the second focus is shown by the wave arrangement. The mercury surface is a good reflector, and by using two plane mirrors and a focusing lens the light from a lantern can be made to give a very good image of the surface on a screen. For this purpose it is well to remove the focusing lens of the lantern and one of the condensers in order to get approximately parallel rays thrown upon the mercury surface.

A spectroscope assembled out of ordinary lecture room equipment was used to show several bright line spectra and also the reversal of the sodium lines giving the corresponding dark lines in the spectrum. The "spectroscope" used is the usual arrangement of lantern, focusing lens, and prism to give a spectrum. The lantern, however, must be hand fed; the various salts and metals are then introduced directly into the arc, their lines appearing superposed on the continuous spectrum of the arc. Occasionally when the lantern becomes filled with comparatively cool vapor, reversal of lines will be obtained. To get this reversal at will put in the path of the beam of light, at its narrowest part, a joint of stovepipe with two slits at opposite sides to allow passage of the light. In the pipe with a blast lamp vaporize a quantity of metallic sodium. The vapor absorbs the wave length in the yellow characteristic of sodium, and black lines appear in their place in the spectrum.

As further examples of spectroscopic apparatus some diffraction gratings of each type, that is, transmitting and reflecting, were shown, some with simple mounting used in laboratory instruction, others with the more elaborate machinery used in research work.

Attention is especially invited to the fact that a large part of the equipment shown is homemade, and that much of it can be dupli-

cated in any shop. No teacher of physics need despair because he lacks finely finished and expensive apparatus. Fortunately we find that the more simple the apparatus is, the more readily does the student grasp the underlying principle, and what we want is not a knowledge of the equipment in any particular laboratory but a comprehension of the fundamentals on which all physical operations depend.

Section B — BIOLOGY

**FACTORS THAT MAKE FOR SUCCESS IN THE TEACHING OF BIOLOGY IN OUR
HIGH SCHOOLS**

BY H. H. WHETZEL, CORNELL UNIVERSITY

When in reply to the kind invitation of your chairman to speak to you on this occasion, I replied that I would attempt to outline what appeared to me to be the factors that made for success in the teaching of biology in our high schools, I felt that it would be an easy matter for me to concrete and classify my ideas on the subject. The task has proven to be not without difficulties. While the four characters or characteristics that I shall briefly discuss are not to be considered the only ones that figure in successful biology teaching, yet they appear to me to be among those of first importance.

Since our ideas and opinions on such a subject are very largely determined by our experiences, I have kept before my mind in the preparation of this paper a few good teachers of biology that I have been so fortunate as to know well. Not all of them are high school teachers. Yet I feel sure that those of them that teach in college or university would be equally successful if teaching in high schools. We should remember that the college freshman is only a high school senior three months later.

With possibly that one exception that proves the rule, I find that every one of these teachers is thoroughly and broadly trained in the subject-matter of biology. They know the subject-matter. They are able to view the whole field and distinguish the great factors in life phenomena. They have clear conceptions of the structure, physiology and evolution of living things. They appreciate keenly the interrelations of plants and animals. They bristle with suggestions of related things. They see the plant not merely as a composite of root, stem, leaf and flower, a thing to be analyzed and named, to be pressed and mounted on a herbarium sheet, but a vitally living organism, thrusting its roots into the soil, seeking and absorbing food and water therefrom, spreading its broad green leaves to the sun and air, that carbon may be gathered for the manufacture of starch and sugar, elaborated foods for the use of the living protoplasm of each active cell, unfolding its rich red blossoms to the insect world that pollination may be effected, fertilization

accomplished and its posterity assured. To know plants and animals in relation to their environment, and to each other, to see them meet and solve the problems of their existence and perpetuation, to understand something of the history of their evolution, this is to know the subject-matter of biology.

I recall also that all these teachers (and here there is no exception), are enthusiastic. They glow with enthusiasm born of knowledge and it is abiding and contagious. Enthusiasm on the part of the teacher begets interest on the part of the student. The teacher for whom every living thing has a message, to whom every living thing presents problems to be solved, can not fail to arouse interest and enthusiasm in pupils. As my own biology teacher used to say, such teachers have the "divine touch." Of none could this be more truly said than of him. A half hour's talk with him would fire me with enthusiasm and energy for weeks of hard work. It does still when I have the good fortune to be with him for a visit. To his inspiration more than to anything else do I attribute my interest and ambition along biological lines. The man who lacks enthusiasm, be he ever so wise, can not teach. His enthusiasm must be broad, it must not be special. The whole field, all the problems must be vital to the teacher of biology. Therefore his enthusiasm must be readily and quickly transferred. The problem in hand today, the plant just found, the animal just captured, must be the thing of vital importance and interest and it must present problems and possibilities.

Another common characteristic of these teachers is that they are hard workers. Every teacher knows that the lesson that receives the most preparation and study by the teacher is the best taught. The interest and enthusiasm of the pupil are directly proportional to the amount of work put upon the subject by the teacher. If you don't believe this try it. I well remember the amazement with which I learned that my biology teacher spent three hours in the preparation of every lecture that he gave us, though he had taught the subject for at least ten years. My amazement continues to this day but it is now that he should have been able to have given such wonderful lectures with so little preparation. Hard work on the part of the teacher is, if properly directed, sure to result in hard work and interest on the part of the pupil. The lazy teacher should never expect pupils to work.

These teachers of mine are all keen observers. They see the great problems of living things in the plants and animals around

them. The waste of weeds beside the path, the stagnant pond, the miry marsh or thorny thicket teem with life and so with interest. What a revelation and inspiration was my first field trip with a teacher who could really see things! I had gone over the same grounds many times before but I had never before seen half the things we found that day. I have since learned that much of the secret of finding living things is in knowing what you are looking for, but more in knowing the related environment, in other words in knowing the organism where it lives, in knowing it at home. But not only must the teacher be keenly observant himself, he must be able to open the eyes of his pupils. Information and inspiration are the clay and spittle of that miracle.

And finally the ability to teach common things seems to me to be a characteristic of all these teachers that I have in mind. They at once related me to my environment. A jar of pond water from a near-by creek brought the first message of cell life, its structure, its physiology, its evolution. Pith from the elder bush I had known all my life, a potato from the patch I had so often hoed, a twig from the basswood tree by the laboratory door, gave me my first insight into the wonders of cell structures, tissues, their specializations and adaptations, division of labor and development of plant organs, etc. Life with all its problems of origin and evolution was at my door. I had only to reach out and take and touch and handle it, examine and delve into its mysteries. The problems were mine for the asking, their solution mine for the trying. For only finding out is fun and only work is living.

AIM AND METHOD IN SECONDARY BIOLOGY

BY MARTHA F. GODDARD, MORRIS HIGH SCHOOL, NEW YORK CITY

What does secondary biology amount to? We hear this question asked again and again. Sometimes it comes in a parent's letter to a newspaper, denouncing the teacher who asked his little daughter to discover how many times a locust breathes in a minute. Sometimes a discouraged young teacher, fresh from college, asks the question, when she finds that the facts she has been cramming into her pupils' reluctant brains are returned to her, if at all, in a hardly recognizable condition. Many college professors tell us frankly that most high school biology courses amount to nothing.

To the parent, we say, "Wait until the year is over before you judge." The young teacher and college professor are in no position to understand the limitations of the immature minds we are teaching, and she, in her lessons, and he, in his entrance examination, have demanded the impossible.

When the question is asked, however, by our own principals, who have been studying these children for years, it is another matter. We acknowledge that biology does not yet mean as much as we hope it will in years to come, but we fully believe that if secondary biology is not amounting to more for our pupils than any other single subject, the trouble is not with biology.

If teachers without training, or with heavy programs including a variety of subjects, are obliged to undertake the work, the measure of success will be limited. Again, the fault may lie with the teacher, for one thing is certain: no class in biology will get much out of a course, if their teacher has not put much of himself into it. "Research work is my joy. I teach to earn my bread and butter," is an unpardonable position for a high school teacher to take. If any of us are guilty of that, our principals may be expected to notice lack of enthusiasm in our pupils.

The pioneer character of our work is chiefly responsible for the results of which certain principals complain. Fifteen years ago, biology had but a small place on our high school curriculum. In spite of what science is doing for us as a nation, we were far behind some European countries in the feeling that every one should understand the rudiments of science. A glance at the accompanying table, showing the amount of science required in classical courses in one of the best Swiss and one of the best American schools in 1897, will show the relative prominence 10 years ago. In many schools the same contrast still remains.

Required science

GYMNASIUM, AARAU, SWITZERLAND					CLASSICAL HIGH SCHOOL, WORCESTER, MASS.				
	1st yr	2d yr	3d yr	4th yr	Total av. per week for 1 year	1st yr	2d yr	3d yr	4th yr
Botany	3	2			2½				
Zoology		2	2		2				
Anthropology			2	1	1½	½			
Mineralogy									
Geology				2	1½				
Physics		2	2	2	6				a5
Chemistry			2	2	4				
Total of science					17½				
Total of required work					119½	78½ or 83½			

a Without Greek.

We have been doing pioneer work and yet we have been expected to be as successful as teachers of Latin, Greek and mathematics.

Our first problem was to decide what we wanted our biology teaching to amount to — what we were aiming at.

To choose the right aim, we are obliged, in common with all teachers, to study our individual pupils and learn their limitations. As biology teachers, we must give especial attention to their environment, that we may select for study the “best things in nature” for them to learn, in order to make “their lives most worth the living,” as Dr Hodge has so aptly described the aim in nature study.

We had to try experiments, and I must briefly review our attempts, for some schools are still following the first paths, which nearly all of us abandoned when most of the biology work was transferred to the pupils of the first year, even though we are still obliged to follow them a little more than seems wise, sometimes, in our elective courses.

To give instruction in the science of biology from the standpoint of evolution was the *first* aim. It was a logical course for ideal pupils, in which a series of typical plants or animals were dissected, drawn, labeled and discussed—if time permitted. Necessarily many entirely unfamiliar specimens preserved in alcohol or other evil smelling preservative, had to be studied. This dissection of preserved material Principal Russell of the Worcester Normal School has characterized as “canned biology.” The logical, evolutionary order of presentation still prevails in our second or elective course in zoology or botany, but at the present time we have little “canned biology” even there. For our first year course, the definite attempt to teach evolution has been practically abandoned. Any one who attempts to condense such a course into one third of a year and to adapt it to pupils of fourteen is attempting the impossible.

A *second* aim, mental training in accuracy of observation and expression, has been and always must be one of the chief aims in biology, as in all study of science. The objects selected to give this training have changed from time to time.

At first, much microscopic study was required, if we were fortunate enough to possess microscopes. Our pupils drew our beautiful sections and perhaps lined them in with ink and carefully labeled them with technical terms. This required time and patience and gave a certain dexterity to the fingers.

Soon most of us felt that the good results were too little, and that all the training in exact observation and description, for which it was to be advocated, might be gained with much less expenditure of time, eyes and interest, from the observation of larger objects, having a more human value; for example, flowers and insects — yes, even the locust of newspaper fame. The scientific vocabulary we find it necessary to teach has also been gradually lessened, for we realize from our own experience, that in three or four years, when the boy goes to college, if he ever does, much of it will be out of date and common English generally does just as well. When the child feels the need of a word to stand for a new idea, we give it to him, and he is grateful and generally remembers it.

We used to do much dissection at first, but there has been a marked decrease of that done by the pupil in class except in elective courses. In fact, in a first year class, there is practically no time for it. The beauty of fresh animal tissue is so great, however, that the pupils ought to see at least one dissection under perfect conditions. A mussy, half dried dissection of an animal is a crime against children, for which there can be no excuse. Better one frog for four or five pupils, freshly killed, pinned out on weighted cork and covered with water, than one for each individual, not prepared as well as possible. The surprised pleasure with which one girl looked up from such a dissection, exclaiming, "Oh, aren't the colors beautiful?" quite paid for the trouble of preparation, and demonstrated the fact that a dissection is not necessarily distasteful to girls. In the human anatomy which follows the animal work, constant reference should be made to the frog dissection, if that is the animal chosen, and the educational value of the dissection will soon be demonstrated.

In place of the study of the anatomy of lifeless forms, the living plants and animals are now the objects of study whenever possible, and not only their structure but their activity is observed. In fact, physiology is emphasized throughout the course. Biology in the high school is becoming the study of life, not death.

Though discipline can not be the *sole* aim in our first year course, it certainly is a very important part of it, and we shall make a mistake if we so load the course that we do not have time to insist on the diagrams and descriptions which we do require, being well and carefully done. There is more training in one exercise well done than a dozen hasty ones, though of course hasty sketches may be useful for other reasons.

As a *third* aim, we are coming to realize the value of biology as a means of culture, i. e., it should broaden the life outlook; it should make a little clearer to the child his place in the living world, and the mutual dependence of plants and animals; it should give new interests to our city children.

That it will do this, was clearly demonstrated by what I saw of biology teaching and its results in Switzerland, ten years ago. Laboratory study of type forms, to give instruction in scientific facts and for training, was then the approved method in our American schools, and a textbook was rarely used at all — in fact a good one for high school pupils did not exist. I happened to board for five or six months in a pension in Zürich, Switzerland, where nearly all the boarders were Swiss or German boys, studying to become chemists, engineers, doctors, etc., in the University and polytechnical School. As it happened, we two American women were the only people in the house who were specializing in biology. I was increasingly amazed as time went on, at the general interest the boys had in the subject and their broad knowledge of plant and animal forms. I realized that the ordinary college graduate in America had no such interest, while our high school graduates from classical courses, similar to those these boys had had, knew nothing at all about biology. Finally, I determined to find out, if I could, how this result had been brought about. Visiting schools is not common abroad, but through the personal letters of Professor Lang and Professor Dodel, I gained permission to visit classes in five of the best Swiss schools. In one city I was refused admittance to one school, even with this introduction, the principal writing that visitors were always a disturbance and that no women had ever visited his school and he did not intend to introduce the innovation. My reception in the other Swiss schools was most cordial and I was given every opportunity to study their methods. In the forty recitations I was able to hear, I saw biology *for culture* at its best. The textbooks were well printed, with good diagrams and a marked absence of technical terms, there were excellent charts, fresh specimens for class use, finely prepared and mounted dissections in the school museums, and the school garden was universal. The teachers were men with broad university training. The pupils had learned their lessons and were very proud of their notebooks. Few American teachers whom I have visited are able to get an equal amount of work out of their pupils with so little apparent effort. I soon saw why my boarding

house acquaintances had such an interest in the subject. I have no doubt that the all day excursions with the teachers, which are a school feature from childhood up, have much to do with the successful classroom work.

Biology for culture has now won a place as one of our aims in our first year work. We choose the objects for classroom study with this in mind, and the fine textbooks and nature books, which are appearing constantly, are making it more and more possible for it to be continued by the pupil after he leaves school. If we can give our pupils new and healthy interests for their leisure time, we are performing a much needed service. A friend recently overheard this remark from a genial, honest-looking traveling salesman, "Well, if a fellow doesn't drink and smoke and go out, life isn't worth living. There is nothing to do." Lectures and museums might form a variation from the theater and saloon for evening amusement, if there was a little interest there to attract at the start. Most city men will say, "I hate the country. There is nothing to do there." Every time we get our classes into the fields and parks, we are making them a little more at home there. Those are the red-letter days in biology and the ones that count for more in the lives of the pupils than weeks of paper correction, for they are giving them a new interest. Even if our pupils have been in the habit of going into the country, it now means more to them, as the casual remark of one matter-of-fact youngster, not especially distinguished for his scholarship — just an average boy — indicates. He was examining some leaf in the vivarium at recess and remarked, "Queer, isn't it, what a difference this biology makes in the way you look at things. When I went to walk, I used to see just trees and things, and now I wonder what is going on inside." One boy who had been hard to manage got greatly interested in his home work in germination and begged more seeds. He proudly brought in a bunch of radishes which he had grown. Another boy and his mother got interested in the pea seedlings and grew them in their tenement until the pods formed. When the pea blossom was studied, he announced that cross-pollination wasn't necessary. "I got some peas on my seedlings and there are no insects in my house to cross-pollinate." Forestry protection orations and debates in the upper classes demonstrate that the interest in trees has not died out with the completion of the biology course. All these interests tend for better citizenship.

A *fourth* aim was added when biology of the first year was made to include the mandatory human physiology. To teachers who were still clinging to the biology teaching for science instruction along evolutionary lines, this seemed a great catastrophe. "Three distinct courses," they said, "botany, zoology, and human physiology,—all in one year and with first year pupils. Impossible!" With physiology as the thread running through the year, this easily becomes the climax for which all the work of the year has been preparing. It is easily seen that an increased interest in outdoor life will improve the pupil physically and morally, but what connection is there between the study of a few plant and animal forms and the physical and moral health of the child?

If we have studied living plants and animals and emphasized physiology throughout the course by experiment and field work, the boy has learned to regard plants and animals as living machines. He has seen the same processes repeated again and again with some variation in the structure of the organs employed. The necessity of proper food and air, and of adaptation to environment has been seen in each case. When he begins the study of his own body, he soon begins to realize that he is simply a more delicately constructed animal, which depends for defence on his more intricate nervous system. If he chooses a city environment, then he must pay the penalty by using his brains to make his surroundings as nearly normal as possible. As he is subject to the same laws of nature as other animals, rules of hygiene are no longer to be regarded as lessons in ethics, but common sense deductions from his study of nature. Problems of sanitation and personal and city hygiene now interest him and that the interest is not confined to the classroom, the numerous newspaper cuttings and magazine articles which he brings in, bear witness.

Since the attempt to teach first year biology from a strictly scientific or evolutionary standpoint has been abandoned, we may be said to have thus far developed a threefold aim, (1) to give mental discipline, (2) to broaden the child's horizon and give him new interests so that he may develop into a happier man and more useful citizen, and (3) to make him a little better able to intelligently care for his own body in the environment where he must live and work.

This is a tremendous undertaking. How shall we best employ the time we have with our pupils each day? How can we help them most without doing their work for them? The laboratory manual

was supposed to have solved the latter difficulty by making the child an independent investigator, but it certainly has its disadvantages, for the class will work unevenly, wrong conclusions will be drawn, unimportant points emphasized and the most important ones lost sight of, or never reached at all by some of the pupils. If it is used, the exercises set must be very short and plenty of time be left for discussion with the teacher. Teaching chiefly by use of a manual tends to become mechanical and nothing must come between the pupil and the teacher. If I try to teach your lesson in your way to my class, I shall surely make a failure of it. It will be very hard for a teacher to find a manual which exactly fits both him and his class. This is probably the reason why so many fine manuals are being published. Each experienced teacher, while he admires many points in the other manuals, finds that they do not quite suit his case, and so publishes his own lesson plans. Before the book is really in the market, he would probably like to write it over. These laboratory manuals are, however, of the greatest service to the teacher in home preparation, especially if he has had little experience. It is like visiting another teacher's class. We must, each of us, getting all the help we can, prepare our own lesson plans, that we may be quite in the spirit of them. Those of you who have read *The Lightning Conductor* will remember how he studied his guidebooks by night, so that he might take his fair charge over the best roads the next day, with the greatest pleasure and profit. She never suspected, you know, how he always managed to find the best view and discover the most interesting things, not realizing how much he had done in preparation.

We feel that we understand a little better than we did fifteen years ago, what biology ought to do for our pupils, but we would ask our critics not to judge our results by statistics alone. Our school authorities in New York city were wise in exempting first year biology from examination for graduation. You may test the facts a boy has learned and his manner of expressing them by a written examination, but how can you discover how much better physically and morally he may be as a result of the course? He may get 100 per cent on the scientific facts of the syllabus and make an exquisite diagram and yet not have gained as much as a boy who failed to get an average of over 60 per cent.

For those of us who are working on this problem, and are sometimes discouraged because of our inability to accomplish our ideal, I will give in closing, with his permission, Dr Cuthbert Hall's esti-

mate of his twenty years' pastorate in Brooklyn. He addressed recently a congregation whose young missionary pastor he had visited in India. He urged them not to estimate their pastor's work by statistics, declaring that they would be most unjust if they did, as he was hard at work studying his people and their conditions. He was finding out what he was to mean to them. He was learning how to fit himself to their needs. Referring to his own pastorate, he remarked that the first ten years were spent in learning the needs of his people and his own powers, the next five years began to show results, but only in the last five did he accomplish anything really satisfactory.

SOME BY-PRODUCTS OF BIOLOGY TEACHING

BY BENJAMIN C. GRUENBERG, DE WITT CLINTON HIGH SCHOOL, NEW YORK CITY

In the manufacture of illuminating gas by distillation from coal, there is left a sticky, tarlike mass that was for years a source of annoyance to the manufacturers of gas, and to the neighbors of the manufacturers. It was a waste product that was not only of no value, but a perfect nuisance, since it had to be removed from the gas stills and disposed of in some way. It was thrown into the streams; which killed the fish and aroused the angry protests of the farmers; it cost so much to handle the stuff that it was a heavy charge on the manufacture of gas, but it was impossible to make gas without producing considerable quantities of it. This nuisance remained unabated until an experimenting chemist hit upon a method of using the nasty stuff for making certain brilliant coloring matters, which are now used by the ton for dyeing ladies' dresses and chromosomes. I don't know whether the price of gas to the consumer has gone down on that account, but it would seem that if for some reason it should no longer be worth while to manufacture gas for lighting and heating purposes, it might still be worth while to make the gas and blow it off into the air, just for getting the coke, the ammonia and the coal-tar, the by-products of this process. I am not prepared to quote the exact figures, but at the present time the substances prepared from coal-tar exceed in actual value that of the gas for which the coal was primarily distilled, by some hundreds of per cent.

Many modern industries are founded upon the by-products of other industries. We are so economical that not a scrap of material is wasted in the working up of cattle to make canned beef, glue, soap, glycerine, oleomargarine, sausage casing, fertilizer, shawl straps and I don't know what else; the total value of these by-products of the canning industry may or may not exceed the value of the net meat, but they are certainly worth saving. If they were not saved and utilized, it would mean smaller profits for those engaged in the business, or dearer meat for the rest of us, or both. If we should all stop eating meat, it might conceivably be still worth while to slaughter cattle for the other products, the by-pro-

ducts. My point here is simply that in the industries the by-products, or the potential by-products, may not be profitably neglected.

In the business of teaching, much doubt has been cast upon the actual value of the product, from time to time. There are men and women by no means stupid who question not only the value of college and high school education, but even that of the bulk of our elementary school education. There is great uncertainty in the minds of the public, and in the minds of many teachers too, as to the real worth to the children of the results of the various efforts comprised under the name of teaching. We hear a great deal about the three R's, and fads and frills, about preparation for life, and culture, and training for efficiency. And the only reason that any one of us who takes the trouble to speak up may get a hearing is, that we are all at sea, teachers as well as taught, and the parents of the taught. It may well be that the process has not been conducted economically, all things considered, that some of the possibilities have been neglected. We must look to the by-products.

When I speak of the by-products of teaching I do not mean the small graft in the way of sample copies of new books, or free tickets to an occasional lecture; nor do I mean the money you can make on the side because you have more leisure than the bricklayer; nor do I mean the glow of satisfaction that you feel when the minister speaks of consecrated lives, nor the gratification yielded by an appreciative word from a former pupil. I have in mind solely the value of the product and of the by-product of the pupil, that is, to the taxpayer, the citizen, the laity. While personally I believe that the value of work should be considered as much for the satisfaction of the worker as for the yielding of various utilizable products for others, I also believe that at the present time we are not in a position to consider any more than the latter aspect of our work.

Now in the case of biology teaching there is as great dissatisfaction as in any other line. One principal complains that we do not give enough information, and in the reaction against informational teaching many of us have no doubt gone too far in the direction of eliminating information. The business man concedes that the information that we do give is curious enough, but he does not see what its value is; and we must admit that it seldom happens that a business man is helped in urging people to buy goods by knowing that insects have three pairs of legs while spiders have four. The

gentlemen and ladies complain that the information about frogs and horse-chestnut twigs may be interesting, but does not give culture, and a particular lady tells me that while her Eddy is just crazy to be outdoors and study flowers and bugs, he is very awkward in company and is unable to converse on literary and other genteel topics. And again other parents complain that while their children got along very well in the grammar school, and with all their teachers, they can not make anything out of high school biology. And so from every possible point of view the results of biology teaching are not satisfactory, with the possible exception of the practical applications that may be made of the results of physiology to personal hygiene.

Apart from information, the only important product that seems to be generally advertised is a certain training or development that is supposed to result from the exercise of the so called mental faculties, like observation, memory, reason and so on. But the psychologists, especially those that know the most biology, are telling us, have been telling us for many years, that the faculty psychology is all wrong, and that you can not strengthen the "faculties" by exercise the way you can the muscles; and our own observation may tell us that the pupils do not show greater ability in the use of these faculties because of their scientific training, except in connection with the materials and ideas they have actually dealt with in their studies. We are forced therefore, I think, to find some other justification for a continuance of our teaching, and I would direct attention to the by-products.

But when I speak of the by-products of this process I do not wish to imply at all that our primary product is of no value, or of minor or secondary value, though it may well be; I emphasize the by-products because we are in no agreement as to the primary product. What seems essential to one seems secondary to others. Under the circumstances it is necessary to catalogue the total product and then determine, each for himself, which he will consider the staples and which the frills, or which the main objects of his teaching and which the secondary objects. It must happen in any such cataloguing that the coordinate terms will be of very unequal value.

The first and traditional result of the educative process is knowledge. In the teaching of biology for information, there are a few groups of ideas, with their related ideals, that are of preeminent value.

In the teaching of physiology, whether plant or animal, a knowledge of the fundamental processes and conditions of life in general should be a major end. The knowledge of structure should be made subsidiary, and in the study of structure the emphasis should be on the degree of adaptation to function. If in the study of adaptation of organs the pupil can be made to feel that true worth is a function of efficiency, and that efficiency is a matter of adaptation to some purpose, there will have been established an ideal that is not biology: it is essentially ethics. I am not confusing efficiency with an ideal of efficiency; efficiency is a legitimate end of education, but I do not think we shall attain to the highest efficiency of anything but machines without this ideal; and the only study that can teach it adequately to pupils of the early high school period is, I believe, biology. But this result, though only a by-product, may not be neglected.

In the teaching of physiology there should be developed the idea of division of labor, and that of the correlation of functions. For example, I have found it worth while to get first year pupils to analyze a factory in their minds, to discover what the essential elements in such an establishment are. After the analysis is sufficiently complete, I ask them to tell me which is the most important factor or part of the plant. On the first impulses, many different details are mentioned by different pupils, but each suggestion is naturally met with objections from the others. I give them time to talk it out, and without any help beyond that of keeping them confined to the problem, they finally come to an agreement on the ground that where each part is essential every part is equally indispensable and therefore equally important. The results of this analysis are then applied directly to organs or organisms under discussion. Without ignoring differences in the relative magnitude or cost or intricacy of the several processes or factors, the pupils can get a very good idea of interdependence, of equality through difference; and this idea generalized is of great value in getting an organic concept of society as against the prevailing architectural concept. This is not biology, but it is a by-product whose value is not to be overlooked.

In the teaching of ecology there should be developed the idea that in addition to the dependence of living things upon certain factors of the environment, there is also constantly a struggle against certain factors of the environment. The pupil should understand clearly that the struggle is against inorganic factors and

against organic factors; and here again the relations between merit and fitness should be emphasized. The study of the relations of plants and animals to their environments and to each other should be supplemented by the study of the relations of plants and animals to man. And in this connection the emphasis should be not on man the merchant, buying and selling, doing business, but on man the living creature that loves to live, without regard to buying and selling. In the larger cities especially does it seem to me very important to fight the prevailing commercial evaluation of the things of nature. The economic importance of plants and animals is mentioned in many of our textbooks and taught by many of our teachers. But too many of our teachers, in the textbook and out, too many of our pupils and too many of our leading citizens see in "economic importance" simply another term for "commercial availability." What is the economic importance of the crustacea? a teacher will ask, and be satisfied if the pupil remembers that the lobster industry amounts to so many million dollars, whereas the shrimps are not so important because—they are eaten only by Frenchmen. It is true that the human importance of lobsters and that of shrimps are approximately in a ratio that may be expressed in terms of the commerce in these commodities; but it is not true in general that the economic importance of any factor of our environment is commensurable with its commercial value. For example, we teach a great deal about the importance of respiration in the life of an organism, but it does not occur to us to speak of the economic importance of the atmosphere. Yet that is just what we should do, and we should place all economic references upon precisely the same basis, namely, the relation to human life and welfare. It is obvious that some of the most important things in human life and welfare have not yet been commercialized, and that the commercial test is as far removed from the human test as any well can be. Whatever, then, the pupils may forget of strophioles or echinoderms or centrosomes; whatever they may remember of angiosperms or parenchyma or trochanthers, of this I believe they can never know too much or too intimately—the intricate relations that exist between the life of man and the lives of other organisms: not in the way of the sentimentalist who will go without a drink to spare the protozoa in the water, but in the way of the master who consciously chooses, as a gardener, what he shall retain and what reject. This is not biology, it is economics—the economics of human happiness.

But in this emphasis on the human side of our subject lies a danger which it is the duty of the biology teacher to anticipate and to overcome, for nowhere else will the high school pupil have a better chance to meet it. I refer to the prevalence of the anthropocentric superstition. Every child brings this with him to school; some have lost a little of it and some have lost more, but probably no first year high school pupil comes entirely free of it. How many pupils leave the high school entirely emancipated from it? While I would constantly emphasize the human possibilities in all the material and ideas utilized in the course, I would just as constantly knock, knock, knock against the notion that these usable and these undesirable things exist because of man. In the teaching of plant and animal physiology there is always opportunity to contrast the *function* of an organ from the point of view of the organism, with the *use* of the organ or organism from the point of view of man. To learn that the progress and welfare, yes, the very existence of man in the midst of his various needs and of the various obstacles to his satisfying his needs, are not the results of a world having been made for him to suit him, but are the results of man's own knowing and doing; to learn that man's mastery of his environment comes only through perpetual striving in thought and in action, is to learn something of which we can not afford to leave any person in ignorance. Whatever else the pupil does or does not learn in school, I believe that this one by-product is of sufficient value to justify the erection of the plant; and I don't know where the pupil can more easily get the results than in the biology course. But this is not biology, it is cosmology.

One other aspect of information that should never be ignored is the teaching of the idea of evolution, with the implanting of the related dynamic ideals. And by evolution one need not mean Darwinism, nor Lamarckism, nor any other special attempt to formulate the process. But if the pupil does not get from his high school biology the evolutionary idea and the dynamic ideal, he is most likely to go out of school without these things, for I don't know where else he can get them. Certainly not from his language work, with its complex rules and interminable exceptions; not from that series of more or less fortunate catastrophes that is taught him under the name of history; not from the adventures and romances that constitute the bulk of his literature; only *possibly* from his mathematics, except for the fact that the laws of mathematics are so abstract and so absolute, so relentless, and therefore so far re-

moved from the apparent chance and irregularity of everyday affairs, that the pupil is more likely to conclude that law is something that exists only in the textbooks and in heaven. The idea of order, the idea of causality, the idea of unity, the idea of constant change, and the ideal of progress, the revolt against the doctrine, "As it was in the beginning, is now and ever shall be," in its ordinary static sense — these things are not biology, but a valuable asset to every person, and a possible by-product of biology teaching.

Biology has borrowed from social science three ideas that have influenced its development profoundly. The idea of evolution, the idea of division of labor, and the idea of struggle for existence have been thus borrowed, with what results we all know. It is the duty of teachers of biology to return to society these ideas, with the compound interest of broadened application and fuller, more definite content.

If we reject the faculty psychology, as we must, we need not reject with it whatever benefits may accrue from the formation of useful habits. The method of the laboratory has been lauded for its remarkable effects upon the character of its devotees — or victims — and much has no doubt been credited to the laboratory that properly belongs elsewhere. But I think there can be no question as to the value of saying clearly and exactly what one means. If the laboratory is not the only place where this habit may be acquired, it is for the high school pupil the place where he can get the greatest amount of practice in this exercise, and under the most valuable control, the control, that is, of the objective limitations to the thoughts he is trying to express. Indeed, I sometimes think that too large a share of our teaching time is taken for doing the work that should be divided among all the departments of the school and which, it sometimes seems, is most systematically neglected by the English departments. The especial advantage of doing language work in connection with the objective material is generally recognized. At the same time we may be tempted to overestimate the importance of getting from each pupil a complete and accurate statement of what he has seen or thought. While we may be sure, when the pupil makes such a satisfactory statement, that he has seen that of which he speaks, we may *not* be sure, when the pupil can neither describe nor draw nor model that which he is supposed to have seen, that he does *not* understand it. And this for the very simple reason that not only does expression follow im-

pression, but it often follows at a very respectful distance. Every one of us knows that in the efforts to learn a foreign language, a stage is reached at which one is quite able to understand a rather long and complex sentence, without being able to formulate correctly a much simpler sentence in the foreign tongue. It may be the same with our pupil; he understands a great deal more than he is able to tell, and the difficulty of the teacher is to know when the pupil *understands* without waiting until the pupil can also *tell* what he understands. Yet if we have to wait for the telling, we have a by-product of great value. But this is not biology, it is expression, graphic or linguistic. And the expression learned in the laboratory has the recognized advantage that it operates under conditions that permit of immediate and constant objective control as to accuracy and adequacy.

I am not sure that science teaching does, as is often claimed, inculcate a love of truth. But I do feel sure that science teaching may impart a keen realization that there is a difference between truth and error which is quite independent of opinion or authority. It may perhaps stimulate in some cases a languid self-reliance. If the question the pupil is moved to ask by a suggestion from the material with which he works is promptly and satisfactorily answered by the teacher, there is great saving of time for the teacher, there is great increase of knowledge for the pupil, and everybody is happy, except a few cranks. For the more the pupil gets information by the mere asking from his teacher, the longer will it take him to learn that the only way the teacher found out was by looking at the material himself or by reading what some other looker had written; the longer will it take him to realize that he can find out more directly and more certainly without asking; the longer will it take him to throw off the superstitious awe for the authorities that have acquired their wisdom in some mysterious way supposedly beyond his reach. It is not necessary that the pupil be left with his specimen and his own resources "to observe," but it is necessary that no opportunity be lost to teach the pupil that most of the questions he asks he can answer for himself; to teach him that the opinions of men and women are of worth just in proportion as they are founded on sound knowledge and on sound inference. To teach one that his own brain with its peripheral organs is an apparatus that can create knowledge as well as that of the writer of textbooks, and to develop a habit of looking to this apparatus for first aid, instead of the habit of asking some-

one else, that is not teaching biology, it is teaching self-reliance in thinking; and this by-product alone is worth the price of admission.

But it is not enough to think boldly and independently; it is necessary also that the thinking be logical and coherent. The study of grammar is under certain conditions nothing but the study of logic, but it is so formal and so attenuated and so much restricted by the special rules, that it is very uncertain, in regard to the pupils who attain high ratings in grammar, whether they are those who were better thinkers before they began the study, or those who acquired the art during the course of the study. On the other hand, the logic of the laboratory, like the expression of the laboratory, is constantly subject to the external, impersonal check. The method of the experiment leaves no room for opinion where certainty is possible. We hear it often objected that the method of science, meaning the method of thought in science, is all right for those who are to pursue the study of science further, but is of no use to the pupils who leave the high school at the end of one or two years. From this view I must dissent, and for the following reasons.

The pupil that becomes a scientist does so only on condition that he is prepared to meet in his problems, prepared, that is, to think as a scientist. But the student that goes into the shop or the factory or the office without any more schooling than he gets by the end of the first or second year of high school, is still to become a citizen and a worker, and it is especially from the point of view of the citizen, who is called upon without any special preparation to declare periodically what shall or shall not be the policy of his city or state, and who shall or who shall not be intrusted with carrying out the will of the people, that the method of science can be of tremendous value. The habit of analyzing complex phenomena is of value to every man and to every woman that has to live in an environment complex enough to support human life. This habit is to be acquired only through the practice of analyzing complex phenomena, and will be regularly exercised only where there is a live realization that phenomena *are* to be analyzed. And nowhere in the school course is there presented an opportunity for such analysis, or for realizing its importance, like that furnished by biology teaching. Very few of the pupils that enter high school ever get a chance to study economics or any other branch of social science; yet every young person that lives long enough is expected to have opinions on the most complex of problems, and that too when most people are not even aware that there is such a thing as

analyzing a problem. They have heard of analyzing water from a suspected well or of analyzing adulterated food; but they don't know anything at all about analyzing the tariff question or the open shop question or the equal pay question. Of course I do not refer to the fact that they do not use the word "analyze" in this connection; but I do refer to the fact that they do not realize that there is such a process and that it must be applied to every question. Now I do not claim that the study of biology will make pupils competent to pass sound judgments upon the public problems that confront the citizen, but I do claim that a habit of analyzing complex problems, the habit of looking for the factors or elements, is a decided advantage in meeting such problems, and this habit our course might establish more or less firmly, by our calling attention to the function of analysis in the activities of the physician or the engineer or the statesman, and to its function in the solution of the thousands of problems that arise in the practical conduct of each individual's affairs. This idea of analysis and the habit of analysis are of great value, but they are not especially biological.

In this connection our old friend the faculty of observation deserves a brief notice. It is quite certain that practice in the observation of flowers and bugs does not establish the general habit of observing everything that comes within the range of our senses. But it is equally certain that a realization of the importance of certain classes of facts will make one both diligent and careful in the gathering of those facts. Now we can make the pupil realize that a knowledge of facts is essential to the solution of various problems, and that the facts are worthless unless they are the results of careful, accurate observation. Beyond that we can only make him familiar with types of structures in which he will discover details and variations more readily after practice: we can never teach a boy to take in at a glance his sister's new millinery dream by the application of the laboratory method to the inside of a crayfish.

The habit of looking beyond facts to their possible significance is another habit that one may conceive to be of value to the person that will never have anything to do with the pallial sinus or fibro-vascular bundles; and the practice of distinguishing between facts and inferences is one that could be of use even in the kitchen. These are matters that may be acquired in the study of language or history, but I believe that the high school pupil has no better

chance to get them than is furnished in the biological laboratory. Yet these products are not strictly biological, they are metaphysical rather, or psychological. Finally, the habit of verification of inference and hypothesis may be established in the laboratory, and once established is an invaluable protection against the browbeating of conventional conservatism on the one hand, and against the allurements of yellowness on the other. And this product too is not biological.

All these methods of science — analysis, observation, inference and verification — will not become fixed habits of pupils unless a special effort is made to generalize their applications to the affairs of the trades and the professions and the interests of everyday life; and biology furnishes the best basis for such generalizations, being on the one hand complex enough to be safe for analogies to practical affairs, and being on the other hand concrete enough to allow of objective and experimental study.

One might be tempted to ask whether I would teach anything in the biology course that is really biological, or whether I would leave anything for other departments of a school to do. To answer the latter question first, I would say that I believe that every subject in the school must contribute its share towards the inculcating of certain ideals, towards the establishment of certain habits of thought and action, and towards proficiency in the arts of expression or communication, in addition to the imparting of information proper to its department. That there are biological matters to be taught in the biology course goes without saying, but these other things to which I have referred are some of the by-products, actual or potential; and we cannot afford to ignore them.

To summarize, I should like to present this plan or ideal for utilizing the by-products of biology teaching:

Teach for thinking, as against merely remembering or believing;
Teach to think straight rather than loosely or crookedly;
Teach to think to some purpose, rather than diffusely, vaguely;
Teach to think to some human purpose, as against merely personal or commercial purpose; and finally,
Teach for an ideal of a dynamic human purpose, as against a static one.

Section C — EARTH SCIENCE

THE USE OF A WET LABORATORY IN PHYSIOGRAPHY TEACHING

Illustrated by lantern slides

BY OSCAR D. VON ENGELN, CORNELL UNIVERSITY

Instruction in a natural science may be broadly divided into lecture work and laboratory work. These terms are inclusive, for under the first heading will come lectures, recitations, and seminary reviews of literature; in general then the acquiring of knowledge of the science from the investigations and the formulations of others; whereas in laboratory work we ask of the individual that he deal with the material itself, make his own observations and draw his own conclusions. Thus we may include field trips, conclusions drawn from assembled data, and laboratory experiments all under this one head.

At first thought it would seem an easy matter, given these elements, to outline a course of instruction which would be adequate to cover the specific need. But difficulties are encountered at various points which are not always of the readiest solution. It is a general impression that in the university the teaching of the subject-matter of the science, rather than its disciplinary value as a study is the chief objective, whereas in the secondary schools a science subject is of value especially as it trains the faculty of observation.

Assuming for the moment that this impression is a correct one, it would seem that, granted the lecturer's knowledge, and the soundness of the text used, the task of university laboratory teaching would be less difficult than that in the secondary schools in the same branch, for on a presentation of the subject-matter the student ought to be in a position to appreciate and follow the laboratory work with interest and profit.

But even if this be true, the deduction drawn is far from being a true one. As a matter of fact the problems are essentially the same, here and in the secondary schools. Powers of observation and deduction acquired in one science, do not necessarily imply the same ability in another; especially in the case of the immature student. If the training of this faculty is the object of the laboratory work of the secondary schools, this same object combined

with an intelligent and broad understanding of the subject is the object of the same work in the university; and the means must be the same.

Here at Cornell, in our laboratory teaching of physical geography, we put the emphasis on, and devote all possible time to, field work. The region is one particularly rich in material, and the opportunities to study a diversity of phenomena are great. Therefore we spend the most possible time in the field, in the fall and in the spring; and we pride ourselves on having developed for the vicinity a series of excursions which are at once comprehensive and intensive. It is in the latter phase that this class of instruction is weakest, for its success is dependent on close observation by the pupil, and the instructor should really be at once an authority in the science, and a teacher of the highest order. Such paragons may exist in numbers among you, but unfortunately elsewhere they are rather rare.

In connection with this field work in physical geography I have found difficulties of two kinds. The one is that the concepts of space, for example the wide area of perhaps hundreds of square miles of a river system, is beyond the imaginative capacity of the beginner, and as a consequence there is a failure to grasp the relationship of the phenomena discussed. We endeavor to overcome this as much as possible by taking the class to high points, which are available here in the hill summits. There may be a suggestion in this for some of you who have also realized this inadequateness on the part of the pupils. Second, there is often the impossibility to convey an appreciation of the result, even when one is at the point where the processes are going on. An example is the postulate that a river must have tools with which to work in carving its valley. The class gazing into the quiet stream can only be told of these tools, and referred to the flood time and its conditions, when their appreciation is dependent on former individual observations. The sum of these difficulties may be compared to the confusion encountered in experimental physics, where the intricacy and the complexity of the apparatus, the number of cocks to be opened and closed, and the mechanism of the often ingenious schemes which have been devised for the securing of quantitative readings or other data, obscures and often diverts the pupil's attention from the real object of the experiment.

Therefore in the indoor laboratory there ought to be a clearing up of the field observations, and a concrete presentation of phenomena not available in the vicinity, or of such a kind as do not permit of actual observation in the field.

The indoor work begins well with a study, as detailed as the nature of the course will allow, of the materials of the earth's crust on which the natural forces are working, and which they produce, i. e. the minerals, the rocks, the soils, and phenomena such as concretions, geodes, ropy lava, etc., which occur.

But by what shall this be followed? Work on contour and hachure maps, the making of a series of profiles and cross-sections? That is practically the gist of the laboratory manuals of physical geography now extant, though there is included some work on models and a number of experiments of meteorological and astronomical kind, which two latter phases we do not treat here, as there are courses given in the university in these subjects.

The use of models is excellent, and their value has long been recognized, so that it is not necessary for me to consider these further than to mention the objections of their frozenness, that they represent the arresting of a process which implies change; and second their nonavailability in great variety.

But to return to the map work. Of what use is it to cross-section contour maps, when the student has but the faintest conception of their meaning and interpretation? This may seem an exaggeration, but I have reason to know that it is not.

Here comes then, first, a place for the wet laboratory. In it the significance and the direction of contour lines can be made clear, as no amount of hypothetical submerging of a boulder or a hat will. We will pause for a moment then to describe the laboratory and the apparatus that we have at present.

The whole equipment was conceived by Professor Tarr, but wholly in a tentative way; as the lack of any previous published work of the character necessitated going ahead according to his judgment as to what would be needed. And so far as our beginning attempts indicate, it entirely covers the needs for the simpler experiments at any rate.

It consists first of a wooden tank, water-tight, some 10 feet square, and 18 inches deep. Inside this is another tank about 6 feet square and 12 inches deep, which can be raised and lowered at will, and tipped to any angle inside the former. The larger tank is to hold the waters of the experimental ocean or lake while in the smaller are built up the land forms. When the building of a certain form is complete the sides and ends of the inside box can be removed if necessary. Then there is a long narrow tank, with dimensions, 20 x 2.5 x 2.5 feet for experimenting on long river valleys; and

third a double tank in a separate room whose temperature is to be under control for glacial experiments. These tanks are also about 10 feet square, but while within one another, they are almost of a size, and some 4 feet deep. Water pipes, sprays of various kinds, and screens for sifting material are also provided. The material we have used to date is clay, molder's sand, sand and pebbles, and plaster of paris.

I will not weary you with the details of the experiments we made to determine what thickness and kinds of layers of strata we needed to use to get the effects desired, but only incidentally call attention to the requirements in discussing the experiments.

These are to date all intended to serve for instruction in an elementary class, although provision is also made for research work to begin soon.

We may then come back to our contour experiment. For this we use the shallow square tanks. Nothing could be simpler than to build up a land form, with hills, embayments, and valleys, and then removing the sides of the inner tank, raise the water surface until it just touched the outer periphery of the land form. The pupils are now instructed to draw the line of the water level on a scale of 1 inch to 1 foot. Then the land is lowered one inch, and another outline is made. With successive lowerings we finally have only the circles and ovals of the projecting hill and ridge summits to put in, and as a result each student has a contour map with a horizontal scale of 1 inch to 1 foot, and with 1 inch contour intervals. The dullest of them can not fail to appreciate the significance of such a map. With this apperception basis (if you will pardon the term) one can with profit set them to cross-sectioning the map they have made, and then to cross-sectioning and profile drawing from topographic sheets.

Our experiments to date have been on the erosional work of streams and waves. We found here that to get results in a short time, nothing more resistant than a clay layer could be used. When plaster of paris even in small proportions was used, the resistance to erosion was such as to make the effects inappreciable after a number of hours of spraying. Again if a heavy clay layer is on the surface, and the angle of slope is moderate, the erosive limit of the developed stream is soon reached, and after that only clear water purls down the valleys. This condition affords opportunity for a very pretty demonstration that streams do their cutting with tools, for by stopping the spray, and sprinkling on a layer of sand

at the head waters, and then resuming operations, we note that the streams now have abundant sediment, and moreover they are cutting back the clay of their middle and upper courses. Again in their lower courses the streams are now overburdened, and as a consequence building up their channels, i. e. aggrading, in order to get a slope steep enough to enable them to carry their sediment load.

If we could demonstrate no more than these few things, we would consider the wet laboratory as amply repaying its installation. For an aggrading stream is a difficult conception with students in itself. But these are only a small part of its possibilities. In the cutting down of one land form many other phenomena can be observed. Thus one of the first and most striking things that one notes, is the extremely wide distribution of fine sediment of a clayey nature, which, even with only one small stream running and the outlet of this stream near the point of discharge of the water from the ocean, yet settles all over the ocean bottom. Thus one can clearly demonstrate the possibility of a vast expanse of stratified rock as due to the deposits of streams entering a former body of water.

Deltas are land forms, which because of their fertility and topography are of the most important geographic controls in the history of man. Yet their slopes and construction are one of the difficult things to make clear in the field. But in the wet laboratory we were surprised from the start by the perfect development of this form which we secured in each case. One could see perfectly how the coarse particles were dumped down the steep slope, the finer clayey material shooting out into the water, and the swinging back and forth of the distributory channels. Again when the material was in the aggregate coarse, the deltas took a crenate outline, whereas when fine they had a smooth curved edge. This has a bearing on our fossil deltas hanging on the hills, composed of coarse glacial gravels for the most part, for these too have the crenate form. As to form, part of the delta could be seen through the water, but it was readily possible to lower the water surface, and disclose the whole. If at this lower level, the spray is started again, we get the condition of rejuvenation, with cutting through of the delta and intrenched meanders in the upper courses.

Other possibilities which suggest themselves at once are the development of alluvial fans, formation and recession of waterfalls, potholes, head water erosion, gorge forms, mature stream courses, migrating meanders, plantation, river piracy, flood plains, and so

on, ad infinitum. Just one more idea and I have done with this part. It is a popular notion that bays are cut in sea and lake coasts by waves and the entering streams, and the contrary, true idea, that these agencies tend to straighten out the coast and obliterate the irregularities is hardly known. Nor can this phenomenon be well shown in the field. Yet this is again one of the most simple things to show in the wet laboratory. The logic of it is irresistible after the pupil notes the waves tearing down the coast, while the currents they generate inevitably fill any original indentations which may exist. At the same time the small irregularities, as sea caves, due to wave work on material of different resistance, can readily be shown, and also how these are distinct from the other larger phenomena. The influence of joints on cliff formation is here immediately suggested.

But it must not be imagined that a wet laboratory necessarily implies only running water experiments. Far from it. Even now we have projected the construction of an experimental geyser on Bunsen's principle, a volcano wherein a chemical mixture, buried under strata, supplies an expansive, viscous, eruptive lava, and a repetition of some of Mr Bailey Willis's experiments in the folding of strata in mountain making. Professor Tarr has also some glacial projects which can not help being instructive. When eventually we get a good series worked up in form so that they can be repeated in schools without too elaborate and costly apparatus, we hope to publish them in the form of a manual with a suggestive outline for work.

**DISCUSSION: LABORATORY WORK IN PHYSIOGRAPHY, ITS ADVANTAGES
AND DANGERS**

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That physiography requires carefully planned laboratory work, as well as field work, for its highest development, has been the opinion of progressive teachers for some time past. Since our true aim in the high school should be development and character building rather than the storing up of facts, nowhere in the curriculum can we find a subject better fitted to our task. Physiography is broad. It involves the understanding of so many related subjects; astronomy, geology, meteorology, lithology, ethnology all contribute to it. The student must be made to realize that physical environment controls living forms and that living forms respond to this environment. The necessary relation which exists between the physical world and man is quickly recognized by the pupil, when he is brought face to face with reality. After all it is reality that educates, and in his observations he sees truth at work. This, then, is a splendid field, and well suited to our junior students in the high school.

Lest some of us might hope or expect to have indoor laboratory work take the place of, or substitute true field work, let me make a plea for the latter. The real observation of natural phenomena is of greater importance, in that it brings the student face to face with "that which is." Nature works slowly, precisely, systematically. She is simple, exact, never obscure and when approached with earnest questions reveals herself. If the pupil has made careful and accurate observations, simplicity, truth and wisdom must follow as a natural consequence. Nature will also make him sympathetic as well as systematic and a good foundation is laid for future work. The student should be led by careful planning to observe, collect data, separate the essential from the nonessential, compare, discover the principles underlying phenomena, and see the relation of cause and effect. He must be accurate and honest in his investigations if he wishes to get true notions and the ability to think correctly. This arouses enthusiasm and a love for work. The student turns from rounded pebbles, crumbling rocks, rushing waters with eyes wide open and with eyes that are never again closed to nature. Out of doors is the true laboratory for the study

of physiography and with the assumption that every teacher has from six to ten well planned field trips, let us pass on to indoor laboratory work.

Here, too, we must open the eyes of our students to the great harmony and system of the physical world.

The teacher should be well prepared, at ease with his subject and above all, in love with it. The pupil is quick to catch the enthusiasm of the instructor. He becomes interested and willing to follow his guidance.

Indoor laboratory work can do little more than supplement field work, by stimulating in the student a direct interest in all that surrounds him and by fostering in him a desire for research, clear, accurate notions and a love for law and order. This interest once awakened is lasting. Try to inculcate in the student a desire for individual work, both in the laboratory and in the field, and reward his efforts with encouragement and suggestions.

Every means that the teacher can procure whether invented or borrowed should be brought to his aid. The equipment of our modest laboratories is at present inadequate and perhaps it is well that this is so.

Expensive, complicated apparatus is not necessary nor advantageous. Have simple, durable material, the best globes, maps, charts, models, a liberal collection of typical rocks and minerals, books for collateral and supplementary reading, contour maps, pictures and diagrams. Do not load the room with lumber which looks scientific, but which is rarely or never used. Add each year to your store, several pieces that you know how to use advantageously, and in a short time you will have a well equipped workshop. Add when possible a lantern and a wet laboratory. Let us consider and freely discuss some of the advantages of laboratory exercises in the developing of science and finally in the development of character building on the part of the pupil. Our students come to us with the ability to learn by rote, and with little power to think. The young child learns so easily by this method, that teachers, all along the line, have taken advantage of it, and unfortunately some high school teachers continue the process. He dislikes to stop and think, and has few concrete notions. In many cases he has lost his orientation with regard to the forces which surround him and it is the province of the teacher of science, and the function of the laboratory to build up common sense notions, and to lead him to discover truth by thinking, reasoning and seeing the relation

of cause and effect. He must be made to realize that lasting knowledge comes from investigation. Ask your young first year pupil to give you a definition of any common geographical feature, for instance a valley. He will recite it glibly enough. Now ask him where he has seen one. In the majority of cases, he will tell you he does not know whether he has seen one or not. Some of the more courageous will risk one in Pennsylvania, Virginia or even California, never one in their own locality. They are positively astonished when they find so many near at hand.

Ask on how many days in the month, all conditions being favorable, can the moon be seen. You will be surprised at the variety of answers. Then let the pupil take a planetarium and work out the problem. Next require careful observations for a month and you will be delighted.

The great advantage of laboratory work is that it gives concrete notions. The student must concentrate his attention upon the material at hand, struggle with the principles involved and by questioning and reasoning, cause the problem to fall apart. He is enabled to meet his conclusions with a mind more and more logically trained and thus he is fitted to enter upon a more difficult task and ready to comprehend its full meaning and significance. As he is required to work and investigate for himself, this gives the restless adolescent a kind of manual occupation which quickens his interest and makes him in a measure see the relation which exists between the earth and man. With a little encouragement he will gain confidence in himself and realize that there is a delight in intellectual power. His energies are turned toward self-education and a healthy attitude regarding duty. He becomes an important factor instead of an individual inhabitant of the class. Difficult problems challenge him and he turns his energies toward them with new power. A healthy curiosity is aroused and he wishes to satisfy it. As laboratory work holds his attention and interest, it is both a preparation for and a review of book work.

In the study of minerals and rocks he must observe closely and accurately, look for fine differences and compare, and this cultivation of the powers of accurate observation is one of the essential elements in his education. By means of contour maps he is brought face to face with all the important features of nature and he is able to understand the influence of environment.

When the pupil reviews his subject he looks from a broader horizon and is enabled to retain the essentials.

Encourage the pupils to make individual models representing some fundamental idea in the lesson. Those who have crude ideas can not do this at first, but those who have vivid imaginations will work out their ideas and benefit the whole class.

Let the pupil explain his model to the class, and if there is a mistake give him the first chance to correct the error. If he does not see it, some live mind will discover it for him. This gives the student confidence and power and keeps the teacher supplied with good material. The taking of weather reports develops the ability to judge correctly, and by observations and correlations he discovers the laws of meteorology.

Are there any dangers to be encountered in this apparently splendid method of presenting physiography? Yes. There are a few. Wherever there is great enthusiasm there is also danger. The teacher, first, must keep in mind, that laboratory work is not an end in itself, but only a means to an end, and that the better understanding of the subject-matter of the textbook.

It should never be made spectacular nor fall to the plane of entertainment. If there is a scattering of attention and energy, it is a waste of time, and should come to an end at once. Then let written work bring out that which the pupil has culled from his investigations. The work may be too technical for first year pupils.

If not guarded against the pupil develops a disinclination for textbook study. The weaker ones are not challenged by the difficult problems presented, as they feel sure that in the laboratory they will be made clear. There is also danger of doing too much, thus causing the pupil to take time and energy from his other subjects.

The work may be interesting and have no real value. The teacher is likely to give too much time to one topic and sacrifice another. For instance mathematical geography, which is taught in the grades, should only be reviewed and referred to from time to time, but most of our students have such vague ideas that it is necessary to develop the whole subject again.

But laboratory work is essentially doing and the labor of preparation and supervision is richly repaid by the responsive interest on the part of the pupil.

The student takes that which the teacher has to give, no more and no less. Let us send our trusts out with a love for investigation and truth. Well balanced characters must follow as surely as the night the day, and our students will revere, through nature, nature's God.

Friday afternoon, December 27

Section B — BIOLOGY

THE WORK OF A CHILDREN'S MUSEUM

Illustrated by stereopticon slides

BY ANNA BILLINGS GALLUP, CURATOR CHILDREN'S MUSEUM,
BROOKLYN INSTITUTE OF ARTS AND SCIENCES

As the work which I represent is not conducted exclusively for high school students one may reasonably ask why a children's museum should be discussed in a meeting of this character. My answer to such a query is that the children's museum exists for children of all ages, from the infant in the kindergarten to the high school senior, and that in proportion as it can help us to a wise and more sympathetic understanding of young children, will it serve as a means of achieving finer results in high school instruction.

As an institution the Children's Museum is only eight years old, and its unique character perhaps calls for a word of explanation about its origin and early history.

It was opened in December 1899, as a branch museum of the Brooklyn Institute of Arts and Sciences, in an attractive residence of a beautiful suburban estate which the city had taken as a public park, the Brooklyn Institute having originally leased the building as a temporary storeroom for collections.

Upon the opening of the new Museum of Arts and Sciences and the consequent transfer of the most valuable property, there remained a few insects, stuffed birds, and mammals principally from Long Island, which were utilized as a nucleus of the Children's Museum collections. Thus the work began with an empty building and the meager exhibits above mentioned.

The manifest pleasure with which children began to use the new museum and its facilities pointed to the necessity for clearly defined plans for expansion.

In outlining such plans the Brooklyn Institute trustees expressed their purpose: (1) To form an attractive resort for children with influences tending to refine their tastes and elevate their interests. (2) To create an active educational center of daily assistance to

pupils and teachers in connection with school work and to offer new subjects of thought for pursuit in leisure hours.

The aims and purposes of such a museum called for: (1) The preparation of collections which children could enjoy, understand, and use. (2) The arrangement of material pleasing to the eye and expressive of a fundamental truth. (3) Brief descriptive labels expressed in simple language and printed in clear readable type.

There was also demand for a system of instruction which children would voluntarily employ.

Time and experience have been necessary conditions for the execution of the original plans thus laid down. As a branch institution, the Children's Museum derives its income for maintenance from the annual appropriation made by the city of Greater New York to the Brooklyn Institute of Arts and Sciences. For the enlargement of its collections it depends upon the work of its museum staff for the collection of materials, and upon the modeler, cabinetmaker, artists, and taxidermists of the Central Museum for highly specialized labor, while the money used in the purchase of new specimens is granted, by special appropriation of the trustees, from a general museum collection fund, composed of private donations and legacies.

After eight years of growth the Children's Museum of today occupies the entire Bedford Park Building, comprising 12 exhibition rooms, a lecture hall, and a Children's Museum Library.

In the exhibition rooms are collections of natural history, geography, United States history, and art, to which children and teachers make constant reference.

Our natural history collections distributed in five different rooms are arranged for children of varying ages.

A synoptic room assists the high school and normal school pupils in studying zoology, while the local collections of amphibia, reptiles, and birds, delight children of all ages.

A room of animal homes contains the nests and family groups of common Long Island mammals and birds, and in the bird room, besides the common migrants, are the condor, lyre bird, cassowary, albatross etc., grouped in a case labeled "Birds We Read About" — where are also appropriate quotations from the authors who have written about these birds.

Our insect collection contains a systematic series of the moths, butterflies, beetles, and other insects of Brooklyn and vicinity, each

specimen accompanied with a label giving the common and scientific names, the sex, and the locality. General labels noting group characters are placed in each section. There are also little model groups picturing what insects do and special exhibits illustrating mimicry, protective coloration, and life histories. An observation hive of bees, a colony of ants, and the various water insects in aquaria are of almost daily use to nature study classes.

In order to make our mineral exhibit pleasing to children we illustrate the economic uses of minerals by displaying mineral products with specimens. With quartz are amethysts and crystal lenses. Flower of sulphur, roll brimstone and matches, with the sulphur crystals form a part of the sulphur exhibit; gypsum is shown with a plaster of paris model, and pictures of mines and processes of manufacture are freely used. Brilliant and beautiful minerals are used for their esthetic effect.

Our museum contains a small historical exhibit which began with old relics, and arms and weapons, formerly used in the wars of our country. These have been chronologically arranged, supplemented with charts and pictures, and more recently with model groups to illustrate the period of colonization and settlement. Six of these groups are now installed, each representing one of the types of European colonists who effected permanent settlement in the United States. In order of their settlement these were the Spanish, French, English, Dutch, New England and Quaker types. There is something about these miniature scenes strikingly engaging to the child. They stimulate him to close and repeated observations and comparisons, and with the help of the childish imagination carry him back into the period to which they belong.

While charts, globes, and maps are used in our geographic exhibits, the model group method has been adopted for bringing together the remote peoples of the world. By means of these miniature scenes human beings appear under extremely unlike conditions of climate and physical features, both of which determine appearance, dress, industries, character, and other distinctions.

The relation of man to his environment as shown in his place of settlement, his occupations and industries as determined by the climate and physical features of his surroundings, and his intercourse with his fellow men are important relationships not always clear to children who study merely globes, maps, and pictures, lacking in that dramatic quality which is an important factor in linking the childish imagination with what is new and strange.

Each scene chosen depicts the natural physical character of the race represented. It shows the members of the family in characteristic dress, the home, and its surroundings, including useful domesticated animals, implements and tools, and men at work. We have begun this series of geographic groups with a choice of those peoples whose mode of life are least complex, since it is among such races that the dependence of man upon his physical environment is most clearly shown, his food, clothing, and shelter often coming from a single source.

The important underlying principle to be emphasized in exhibits of this character is that of relationship. The child is ever ready to put himself in the place of the lilliputian being whose environment he now sees spread out before his eyes. What his far away brother has and what he can do, are to him important subjects about which he asks many questions.

We try to get in touch with children through the schools, for experience shows that the best results are obtained through co-operation with enthusiastic principals and teachers. Our exhibits are therefore correlated with the public school work, and lectures supplementing grade courses of study are regularly given during the school year. Pupils are informed of these lectures through the *Museum News*, a monthly publication which is mailed to the principals of the schools, and once they begin coming to the museum they usually continue their visits.

Between the hours of 9 a. m. and 5.30 p. m. on every week day and 2.30 and 5.30 p. m. on Sundays when the museum is open, children are welcomed and encouraged to the fullest enjoyment of every attraction.

A Children's Museum Library which occupies two rooms in our building and forms a part of the museum work contains about 5000 volumes consisting of the best works on natural history in its broadest sense. The library provides books of information for visitors and in offering books on the lines of school work forms a valuable school reference library adapted to giving assistance to teachers and pupils. The two trained librarians permanently in charge of the reading rooms enable visitors to consult books without formality or loss of time.

In the absence of official relations with the public schools, the museum attendance is exclusively voluntary. Children and other visitors usually arrive with some definite end in view and the members of the staff endeavor to assist toward that end.

We try to give our visitors the same freedom and pleasure that they would experience in entering a delightful home where every plan is for the enjoyment of guests. Members of the staff are always happy to escort visitors, to answer their questions, take specimens from the cases for closer examination or tell stories to younger children.

Schoolboys and girls have learned that the museum will help them over many a hard task assigned by their teachers, and thus the work of the museum has become as diversified as the individualities of its visitors.

Principals, teachers, and parents unite in their testimony as to the quickening influence of the museum on the mental growth of their children and an increasing number of teachers find time to bring classes for supplementary half hour talks. Additional credits in school are frequently offered to pupils who give satisfactory evidence of having profited by their visits. The museum makes no demand on its visitors.

It offers its privileges free to children of all ages and leaves each one to choose his own method of enjoyment. Whether he copies a label, reads an appropriate quotation, talks about the group of muskrats with his playfellows, spends an hour in the library, or listens to the explanations of the museum "teacher," who gladly answers his questions and tells him stories, matters but little so long as the effect of his visit is to enhance his love for the best things in life. Another privilege extended to schools is the free use of stuffed birds, boxes of insects, and other "loan material" distributed for classroom study.

The demand for the privileges of a children's museum may be seen from the readiness with which schools and individuals accept them. More than 125 schools, many of them remotely situated, send pupils and teachers to our museum. Six hundred and thirty-two (632) visits from teachers alone in search of definite information, were recorded in the school months of 1907, and for the same period the Children's Museum lectures attracted an attendance of 18,000. The average annual attendance for the past five years has exceeded 94,000 visitors. It would seem from these statistics that a children's museum, if not a life necessity, is indeed an unquestioned blessing to a great city like our own whose population is boxed in apartments or brownstone blocks of such vast extent as to place the country beyond the experience of many children.

The advantage of a cheerful, sunny, attractive museum, rich in natural objects artistically displayed, where children are sure to find a sympathetic welcome, where they are safe and happily and profitably occupied, is scarcely appreciated until we pause to consider the influence for good or evil of habits acquired in leisure hours — and of the demoralizing influence of crowded city streets and back alleys.

Many of our “boys” and “girls” who are now young men and women paid their first visits to the museum in company with their parents or the family nurse. Year by year they have returned to the museum attracted by new features of the work adapted to their growing intellectual needs.

Two years ago in response to an expressed demand from the boys the museum began a course of lectures in elementary physics and in connection therewith invited the boys to come to the museum on certain afternoons to experiment individually with pieces of apparatus that most interested them. The boys found the utmost pleasure in the liberty thus granted — they experimented, under the guidance of a member of the museum staff, they read library books in connection with their experiments and within a few months several of the boys had set up a wireless telegraph station. The original work of these boys would be a credit to any institution for they applied themselves regularly and diligently until they had learned to send and receive wireless messages, meanwhile the experience of placing the station and keeping it in working order had fitted them to take charge of other stations. Early this summer when the schools closed, three of these “boys” received offers of remunerative positions with one of the commercial companies to take charge of wireless stations on board of ocean-going steamships to the West Indies, Bermudas, Key West, and other places of interest along the Atlantic seaboard. One of the boys who had learned to collect and mount insects when he came to the museum as a primary school lad made a very creditable collection of tropical insects which he brought to the museum carefully preserved and labeled with interesting data.

In contrast to the achievements of these boys by a wise use of spare moments, we can but wonder what these hours would have counted for if there had been no museum, no books, and no sympathetic personality to offer an occasional useful suggestion.

It has been maintained by some that physics and electricity are subjects not germane to museum work and that a museum should

remain loyal to its old purposes of collecting, preserving, classifying, and exhibiting objects of scientific value. While the original object of a museum should be kept in mind we must not lose sight of the fact that a children's museum calls for such modifications and adaptations of methods as will enable children to use it, and here we must remember that the keynote of childhood and youth is action. Any museum ignoring this principle of activity in children must fail to attract them. The Children's Museum does not attempt to make electricians of its boys, nor is its purpose to do the work of any school. Its object is rather to get as near to the tastes and interests of its little people as possible, and to offer such helps and opportunities as the schools and homes can not give. With that its mission ends, and the success or failure of its work will be proportioned to its skill in meeting individual needs.

About a year ago a small boy was discovered in our building leading his 11 year old blind brother by the hand and telling him as much as he could about the objects of especial interest. The eagerness with which this sightless lad drank in every descriptive sentence led the museum escort to ask him if he had ever "seen" a squirrel. "No," he said, "I never touched one, but I have heard stories about squirrels—they have long, bushy tails and eats nuts." The escort then placing a stuffed squirrel in his hand, gave him one of the happiest experiences of his life. To his book knowledge he could now add a real discovery. Nor did his experience at the museum end with the squirrel, his sense of touch taught him many other stuffed animals and birds, besides living frogs, lizards, and turtles. There were other museums in Greater New York and surely far more costly exhibits, but no museum had hitherto found time to give this blind visitor the special attention his infirmity made necessary. Repeated and prolonged visits demonstrated the sincerity of his statement that "he felt as though he had come into a new world with all these animals."

Every September, children returning from the country outings hasten to tell us of their holiday pleasures, not the least of which, is the deeper appreciation of the world of nature of which the museum has given them broader knowledge. Examples of the quickening and stimulating influences of the museum in individual cases could be multiplied indefinitely and to this could be added the appreciative testimony of parents and teachers, were it necessary to prove by argument its real value to the community.

But, happily, the day is passed when its excuse for existence is questioned, or when it is regarded as an extravagant investment, yielding small returns. On the contrary, the returns would warrant an increased expenditure and this seems to be a necessity of the near future.

The present Children's Museum has long since outgrown its quarters. Its exhibition halls, its lecture room, and its library are often so overcrowded with eager children as to defeat the objects of their visits.

The New York Legislature, however, has recently passed a bill authorizing the city to erect a new children's museum building at a cost not to exceed \$175,000. With the improved equipment thus provided the Children's Museum would not only serve a larger number of children, but would also serve them more efficiently in proportion to expenditure.

Through publications from the German press we learn that certain educators in Berlin advocate a children's museum for that city. Meanwhile, in our own country, museums are beginning to feel the importance of giving more attention to the education of children.

Since the Children's Museum has demonstrated its worth to one community there is reason to expect that it will make its way into others and the variety of problems to be solved in adapting its work to new conditions offers one of the most attractive fields in modern education.

Section C—EARTH SCIENCE

**STREET CAR EXCURSION TO POINTS OF PHYSIOGRAPHIC FEATURES OF THE
ITHACA REGION**

LED BY OSCAR D. VON ENGELN, CORNELL UNIVERSITY

Board special car at Cornell University Library at 2 p. m.

Stop no. 1 Beebe lake bridge. Amphitheater and gorge succession in stream courses. Cause of the widening at the lake, and the gorges above and below. Other instances in Six Mile creek and bearing of these on theory of two glacial periods.

Stop no. 2 Fossil deltas of Cornell Heights. The glacial ice dam and its northward recession. The lake stages. Evidence of marginal channels (south hill) and old shore lines of their existence. Coy glen succession of deltas.

Stop no. 3 The ice eroded Cayuga valley. Double slope of the valley. Its overdeepened condition (423 feet to bottom, surface 381 feet above sea level). Joint plane and wind direction influences on cliff foundation. Dip of rocks.

Stop no. 4 Fall creek falls hanging valleys. Cause of numerous waterfalls. Variation of waterfall form. Joint plain development here and at Taughannock. Falls over the Tully limestone of Niagara type dissection of fossil deltas.

Stop no. 4 Renwick park. The delta plain. Levelness. Structure of plain. Artesian well conditions. Upbuilding of plain. Outbuilding of plain. Limit of plain under lake. Steep front 45 feet to 139 feet, $1\frac{1}{4}$ miles out. Position of side deltas with reference to wind direction.

Stop no. 6 Library Slope. Location of Ithaca. Comparison with Watkins. Alluvial fans. Position of inlet. Control of topography on transportation. Early history. Salt industry. Gypsum. Early geological conditions in this region.

Inspection of Geological Laboratories.

Friday evening, December 27

ELECTRICAL OSCILLATIONS

(Abstract)

BY J. S. SHEARER, CORNELL UNIVERSITY

The part which oscillatory changes play in modern physics has been only partially appreciated although of increasing importance during recent years. The simplest phenomena of this type is shown in the vibration of a strip of thin metal or wood clamped in a vise and carrying an adjustable load.

The type of vibration is determined by the shape and nature of the strip and its frequency by its rigidity or elastic return force and by the amount and distribution of the load.

Increase of elastic return force raises the frequency and decrease of load or placing it so that its inertia is less effective will act in the same way. We have in the knowledge of this fact the key to the control of such a vibratory system by regulation of these two quantities. Note that this mechanical vibration requires the expenditure of work in order to start it, the inertia of the mass carrying it past the equilibrium position. After the first supply of energy only enough need be given to supply the friction loss, in this case, a rather small amount.

In the mechanical case we see a moving mass and by reason of the muscular force exerted in starting it we realize in a vague way the variable force action involved. When, however, we deal with the electrical form of energy we can see no moving mass, we do not control the system by direct muscular force action and thus may fail to grasp the situation without recourse to some mechanical analogy.

For convenience let us suppose that electricity does consist of two unlike kinds of material of some intangible form and that equal parts of these two sorts are present in the normal state of all ordinary masses. Assume further that when one of these which we call + is in some way separated from the one called — there is set up a tendency to return to the original condition. Any electrical machine, cell, battery or dynamo is then a device for the separation

of these + and — quantities and the work they do is stored in the form of electrical potential energy so long as the charges are kept separate. If the physical conditions are properly arranged the rush of charge when opportunity for readjustment is offered in part reverses the distribution of + and —, in other words sets up an oscillation of electricity analogous to the oscillation of mass.

In this case also there are two factors by means of which control may be secured as to frequency although the number of oscillations per second is almost incredibly large. One of these is the electrical capacity of the circuit which determines the amount of charge involved when the potential is fixed, and the other relates to the difficulty experienced when an electric current is started or stopped, in other words, to the self-induction of the circuit. Expressed in symbols the frequency depends on the $\sqrt{LC}$ where C is capacity and L is self-induction. When two circuits are so built up that the product LC is the same in each they are said to be in "tune." And oscillations set up in one will cause less vigorous electrical vibrations in the other. The effect of tuning was shown by several simple experiments illustrating the effect of change in each factor L and C.

Saturday morning, December 28

Section A — PHYSICS AND CHEMISTRY

THE STUDY OF SCIENCE BY YOUNG PEOPLE

BY WILLIAM S. FRANKLIN, LEHIGH UNIVERSITY, SOUTH BETHLEHEM, PA.

The philosophy of the 17th century for us of the 20th! Indeed I would have it so for my present purpose at least, and I ask you to adopt with me the intensely practical philosophy of that remarkable man of the world, Francis Bacon, who declared that "The real and legitimate goal of the sciences is the endowment of human life with new inventions and riches." Bacon's philosophy, which is a naïve admixture of insight and confusion, certainly stands for this idea, the service of science to mankind; and yet the scientific work of the 16th century, from which he drew his inspiration, pertained to realms very remote indeed from the doings of men. But now, after an era of scientific activity which is unprecedented in the history of the world, and which moreover relates to the things that all men use and to the things that all men do, what limit can be set to Bacon's kind of philosophy? At any rate it pretends to a conquering destiny. "We advise all men," says Bacon, "to think of the true ends of knowledge, and that they endeavor not after it for curiosity, contention, or the sake of despising others, nor yet for reputation, power, or any other such inferior consideration, but solely for the occasions and uses of life."

In his striking essay on the *Advancement of Learning*, Bacon surveys the coast of what, in view of the then recent developments of science, he is pleased to call "The new intellectual world," and before proceeding with what he apparently considers his greatest constructive effort, the *Novum Organum*, which is but dimly intelligible after the mutations of 300 years, he enumerates in his quaint way the deficiencies of knowledge in his time, and among other deficiencies he mentions "The Traditive Lamp, or the proper method of delivering down the sciences to posterity." The physical sciences, however, in their intimate human significance, are but newly created, and it is for us now to raise the question as to the proper method of delivering them down to posterity, and it seems to me that the

greatest deficiency of knowledge in the realm of the physical sciences today is still that which was pointed out in semiprophecy by Bacon 300 years ago as the "Traditive Lamp."

My object in this paper is to establish a point of view from which we may consider in a broad and practical way the problem of "delivering the sciences down to posterity." The discussion will contain much that is light and common, but "We, who know that no judgment can be formed of that which is rare or remarkable without a previous regular examination of that which is common, are necessarily compelled to admit the most common objects into our discussion. Besides we have observed that nothing has been so injurious to philosophy as this circumstance, namely, that familiar and frequent objects do not arrest and detain man's contemplation, but are carelessly admitted, and their causes never inquired after: so that information on unknown subjects is not so much needed as attention to those which are known."¹

Before proceeding with my main argument I wish to traverse a portion of a lecture² I gave several years ago to the older scholars of the Bethlehem schools in the attempt to justify in the minds of my young friends the coercion which is so prominent in modern technical and scientific education. In this lecture I endeavored to draw a sharp contrast between what may perhaps be called the normal activities of boys, and the activities that are involved in the rational study of the physical sciences, and I must let my words stand in their original form as addressed to the young people themselves in order not to eliminate a personal element without which the contrast vanishes.

Science, as young people study it, has two chief aspects, or, in other words, it may be roughly divided into two parts, namely, the study of those things which come upon us, as it were, and the study of those things which we deliberately devise. The things which come upon us include weather phenomena and every aspect and phase of the natural world, the things we can not escape; and the things we devise relate chiefly to the serious work of the world, the things we laboriously build and the things we deliberately and patiently seek.

You are, of course, familiar with the accepted division of science into biology, the science of plants and animals, and physics, the science of machines (what is a telescope, a test tube, or a still but

¹ Novum Organum, bk I, § CXIX.

² The first of a series of simple experimental lectures on physics.

a machine?). To a certain extent this corresponds to the division of science above mentioned, but, strictly speaking, the division of science into biology and physics has little to do with the distinction between the things that come upon us and the things we devise, and yet it is necessary for my present purpose to divide science on the basis of something which stands out clearly and distinctly in your eager souls so as to leave in every minute fraction as much as possible of the vital qualities which give pleasure or exact pains. Let us, therefore, divide nature on the basis of work and play; on the basis of painstaking and deliberate contriving on the one hand, and on the other hand of spontaneous and irresponsible joy.

In this mention of both work and play you may think that I am trying unfairly to catch your attention by alluding to the one thing you like above all others. Indeed, the things I shall ask you to consider during the winter are much more closely connected with work than with play, for the things we know best in physics today have to do with railways and ships and factories, and the things in physics which are most worthy to be known by every one are precisely these things which relate to the world's work.

On account of the remote connection between physics and play, and because of the great predominance in physics of the things which have to do with work, I am inclined to spend a portion of this, our first hour, free from the constraint that work implies, and to consider for a while the school of play, and that great school and playhouse, the Land of Out of Doors.

The friendly cow all red and white
I love with all my heart;
She gives me milk with all her might,
To eat with apple tart.

She wanders lowing here and there
And yet she can not stray
All in the pleasant open air
The glorious light of day.

To you, my young friends, everything is, I know, a joyful out of doors, and there you can not stray, all in the pleasant open air, the glorious light of day. To your fresh enthusiasm pretty nearly everything is play, and knowing no offense you accept, at par, ever aspect and phase of life, men, machinery and the enduring hills. I caution you to retain as you grow older as much as you can of this wide, and let us call it, matter-of-fact tolerance. Accept



men and learn kindness and pity, accept machinery and learn dominion, and keep undefiled the sunlit hills and learn delight in life.

The Land of Out of Doors! What irony there is in such glowing phrase to city boys like yourselves! The supreme delight of my own boyhood days was to gather wild flowers in a wooded glen to reach which led across a sunny stretch of wild meadow rising to the sky, and I would have you know that I lived as a boy in a land where a weed never grew!¹ Next to this delight in wild flowers and their haunts, my greatest delight was to watch the workings of a great sawmill, to see men play, as it seemed to me, eyes following every motion, ears filled with sounds like music in their sufficiency, heart leaping at every kind attention. A favorite uncle worked there for my father, the happiest man I ever knew, and since those early days I have learned but little about machinery, not much worth knowing about men, and nothing at all about meadowed hills!

When I was a boy I believe I would have walked almost any distance to see the inside of a turbine water wheel or to see one of those, even in my boyhood, old style and out of date water wheels which stand in picturesque decay in nearly every locality in these eastern states. I wonder how many of you have seen either kind, or even know that both kinds can be seen, inside and out, in our own neighborhood. Water wheels are perhaps a small and insignificant matter, too insignificant to warrant a trip to Easton² it may be, but what of the unparalleled opportunity which

¹ The western prairies, except in the very center of the Mississippi valley, are beautifully rolling, and they meet every stream with deeply carved bluffs. In the early days every stream was fringed with woods; and prairie and woodland, alike, knew nothing beyond the evenly balanced contest of indigenous life; and then there came a succession of strange epidemics as one after another of our noxious weeds gained foothold in that fertile land. I remember well several years when dog-fennel grew in every nook and corner of my home town in Kansas; then after a few years a variety of thistle grew to the exclusion of every other uncultivated thing; and then followed a curious epidemic of tumble-weed, a low spreading annual which broke off at the ground in the fall and was rolled across the open country in countless millions by the autumn winds. I remember well my first lone "beggar louse" and how pretty I thought it was! And my first dandelion, and of that I have never changed my opinion!

² The lecturer had a few days previously taken several small boy friends to Easton to see a large water wheel which was being repaired. The superintendent of the plant put on overalls and went with us into the interior of the large boilerlike casing where we could see and touch the vital parts of the wheel. After the boys had examined the wheel, one of them perched himself on the topmost part in the dimly lighted interior and said, forgetful of the superintendent's kindness, "Pshaw, this isn't worth coming from Bethlehem to see!"

Bethlehem boys have amid the varied industries of the Lehigh valley! Do you care nothing to know about these things? or do you imagine that they are too complicated for you? Whatever you think, you must run them yourselves 20 years hence, or starve.

I wish that all youngsters might have access to the places where the wild flowers grow and have wide opportunity to see their fathers at work. A hundred years ago these things were really within the reach of every boy and girl, but now, alas, many a bright boy has seen no other manual labor than the digging of a ditch in a cluttered street, while many another, stunted in skill, has almost become a part of the machine he daily tends, and Boyville has become a paved and guttered city, high-walled, desolate, and dirty; with here and there a vacant lot hideous with refuse in early spring and overwhelmed with an increasing pestilence of weeds as the summer days go by, and the strangest thing about it all is the much too matter-of-fact tolerance among young people which accepts unquestioningly, and even with manifestations of joy, just any sort of a world if only it is flooded with sunshine.

I remember how in my own boyhood the rare advent of an old tin can in my favorite swimming hole used to offend me, while such a thing as a cast-off shoe was simply intolerable, and I do not wonder that the unquenchable delight of boys in out-of-door life becomes an absolute rage in its indifference to the dreadful pollution of the streams and to the universal pestilence of weeds and refuse in our thickly populated districts. I can not refrain from quoting an amusing poem of James Whitcomb Riley's which expresses, more completely than anything I know, the delight of boys in out-of-door life where so many things happen and so many things lure, and you can easily catch in the swing of Riley's verse that wanton note which is ordinarily so fascinatingly boyish but which may too easily turn to a raging indifference to everything that makes for purity in this troubled life of ours.

THREE JOLLY HUNTERS

O there were three jolly youngsters;
And a-hunting they did go,
With a setter-dog and a pointer-dog
And a yaller-dog also.
Looky there!

And they hunted and they hal-looed;
And the first thing they did find
Was a dingling-dangling hornet's-nest
A-swinging in the wind.
Looky there!

And the first one said "What is it?"
 Said the next, "Let's punch and see,"
 And the third one said, a mile from there,
 "I wish we'd let it be!"
 Looky there! (Showing the back of his neck).

And they hunted and they hal-looed;
 And the next thing they did raise
 Was a bobbin bunnie cotton-tail
 That vanished from their gaze.
 Looky there!

One said it was a hot base-ball,
 Zippt thru the brambly thatch,
 But the others said 'twas a note by post,
 Or a telegraph-dispatch.
 Looky there!

So they hunted and they hal-looed;
 And the next thing they did sight,
 Was a great big bull-dog chasing them,
 And a farmer hollering "Skite!"
 Looky there!

And the first one said "Hi-jinktum!"
 And the next "Hi-jinktum-jee!"
 And the last one said, "Them very words
 Has just occurred to me!"
 Looky there! (Showing the tattered seat of his pants).

This kind of hunting is, I assure you, better than the kind that needs a gun, and to one who falls into the habit of it, the gun is indeed a useless tool. I remember a day I spent with a gun in a remote part of the Rocky mountains where, during the 25 days I have camped there on four different trips, I have seen as many as 150 of the wildest of animals, the Rocky mountain sheep, being almost run over once by a group of five. On the day in question I became so interested in killing mosquitoes—I timed myself at intervals while I lay in ambush, 80 per minute for three hours making an honest estimate of 14,400—I became so interested, I say, that the sheep came, and were out of range again before I saw them, and I was hungry too. I fancy they were not frightened but wished the good work to go on undisturbed.

Ich ging im Walde
 So fuer mich hin
 Und nichts zu suchen
 Das war mein Sinn.

What I have chiefly in mind, however, in speaking to you of that great school of the Land of Out of Doors is what is nowadays called nature study. Do any of you like candy? Did you ever

consider that the only sweetmeat our forefathers had for long thousands of years was wild honey? And those sour times — if I may call them such — before the days of sugar and candy, come much nearer to us than many of you realize, for I can remember my own grandfather's tales of bee hunting in Tennessee. Just imagine how exciting it must have been in the days of long ago to find a tree loaded with candy! A bee tree! If any one of you were to go back with me to the wild woods of Tennessee, some thrill of that old excitement would well up from the depths of your soul at finding such a tree, even if you were the son of Huyler or a nephew of the sugar trust. You may wonder what I am driving at, so I will tell you, that one of the most exciting experiences of my boyhood days was a battle with a colony of bumblebees. I was led into it by an older companion and the ardor and excitement of that battle, as I even now remember it, are wholly inexplicable to me except I think of it as a representation through inherited instinct of a 10 thousand years' search for wild honey.

It is my firm belief that nature study, as the natural boy knows it, grows out of the play of emotions and activities which constitute instinctive reactions toward natural things, hunting and fishing, digging and planting in the spring, nutting in the fall, and the thousands of variations which these things involve, and I believe that the play of instinct is the only solid basis of growth of a boy. I believe, furthermore, that the very essence of boy humor is bound up with the amazing incongruity of his instincts. Have any of you ever fooled a dog by placing him on a false scent, his instinct leading him astray? It is not easy to do, but done, it is mighty funny, and any decent dog enjoys the joke. Was there ever a boy whose instincts, many of them mere fatuity like his digestive appendix, have not led him time and again into just thin air, to say nothing of water and mud! For my part I have never known anything more supremely funny than learning what a hopeless mess of wood pulp¹ and worms a bumblebee's nest really is, except, perhaps seeing another boy learn the same stinging lesson.

The use of formulas, too, is unquestionably instinctive, and we all know how apt a boy is to indulge in formulas of the hocus-

¹ The "honeycomb" of the bumblebee is made of the paperlike material which wasps build their nests of, and every cell is filled with a big fat grub! No honey there! My friend Prof. H. S. Carhart assures me, however, that he has had better luck than I — in the end.

pocus sort, like Tom Sawyer's recipe for removing warts by the combined charm of black midnight and a black cat, dead; and a boy arrives only late in his boyhood, if ever, to some sense of the distinction between formulas of this kind and such as are vital and rational. I think that there is much instruction and a great deal of humor connected with the play of this instinctive tendency. I remember a great big boy, a hired man on my grandfather's farm, in fact, who was led into a fight with a nest of hornets with the expectation that he would bear a charmed skin if he shouted in loud repetition the words "Jew's-harp, jew's-harp."

To reproduce for the city boy something approaching the solid reality and exquisite humor of the country boy's life is the well-nigh hopeless function of what our school teachers call nature study and of one class of children stories. Many storybooks are devoid of this vital element of humor, however, in that they relate too much to the complete and finished deeds of grown-up men. Robinson Crusoe, for example, never appealed very strongly to me, and, I think, for this reason Mr T. B. Aldrich's *Story of a Bad Boy* is, I am sure, a much better book.

I think you will agree with me that nature study is a complicated and elusive thing to be fully achieved only in the green school of the Land of Out of Doors; to young people the best playhouse, and to older people an endless asylum of delight.

The grass so little has to do,
A sphere of simple green
With only butterflies to brood
And bees to entertain.

And stir all day to pretty tunes
The breezes fetch along
And hold the sunshine in its lap
And — bow to everything.

And thread the dew all night, like pearls,
And make itself so fine,
A duchess were too common
For such a noticing.

And even when it dies, to pass
In odors so divine
As lowly spices gone to sleep
Or amulets of pine.

And then to dwell in sovereign barns
And dream the days away
The grass so little has to do —
I wish I were the hay.

All of you have, no doubt, followed what I have said concerning nature study with some degree of understanding, or at least with some degree of amused interest, and, I assure you, that I do not insist on the distinction between these two points of view. I am quite as well satisfied with the one as with the other in dealing with nature study in which the element of humor is so much more vital than the element of reason, but in undertaking to express my views of the study of the physical sciences, I shall be subject to severe limitations in the mode of my appeal to you, for here the element of humor is entirely lacking and reason alone prevails.

The study of the physical sciences does not depend upon the play of instinct to anything like the extent that nature study does, and you all realize that, while the elemental study of physics which consists in the visiting of mills and factories may be interesting to any boy, it is, nevertheless, devoid of the peculiar delight that all boys find in hunting and fishing. This elemental study, the seeing and handling of things, is not, however, the same thing as the study of physics in school. The study of the elementary physical sciences in school is, or should be, imaginative like the study of geometry, the object being to build up in the mind of the student a structure of notions and ideas on the basis of which he may be able to see into things.

Another aspect of the difference between nature study and the study of the elementary physical sciences relates to the newness of the physical sciences as a phase of human activity, whereas nature study, the kind I have told you about, is as old as the race. This nature study is really a recapitulation in the growing child of the entire history of the race, while the study of physical science, except in its rudiments, is a training which is to a great extent devoid of recapitulative elements.

What I wish to say to you, however, concerning the change in your mode of thought which must take place before you are fully entered into the life which modern science has prepared for you, may best be expressed by referring to the life history of a remarkable little animal, the axolotl, a kind of salamander, which lives a tadpolelike youth and never changes to the adult form unless a stress of dry weather annihilates his watery world; but he lives always and reproduces his kind as a tadpole, and a very funny looking tadpole he is, with his lungs hanging from the sides of his head as two great feathery tassels, brownish in tint, from the red blood inside and the mud that settles on the outside of the tiny tube-

like streamers. I caught¹ one of these curious creatures when I was a boy and caged it in an aquarium, and I was greatly interested years afterward to learn more about it and to be told that it is a very rare animal indeed in my native state although plentiful enough in Mexico. When the aquatic home of the axolotl dries up he quickly develops a pair of internal lungs, lops off his tassels, and embarks on a new mode of life on land.

If you, my young friends, are ever to develop beyond the tadpole stage and become complete men according to the fullest present day significance of this term, you must meet, with quick and responsive inward growth that new and increasing stress of dryness as many men are wont to call our modern age of science and industry.

The best way, however, to characterize the study of physics is to take a concrete example. With this object in view, let us discuss briefly Newton's laws of motion. The most prominent aspect of all phenomena is motion. In that realm of nature which is not of man's devising motion is universal; ripple of brook, and gentle flow of river, ocean's swell and slow recurrent tide, and over all, incessant gusts of wind infinitely varied. In the other realm of nature, the realm of things devised, motion is no less prominent. Every purpose of our practical life is accomplished by movements of the body and by directed movements of tools and mechanisms, such as the swing of scythe and flail, and those studied movements of planer and lathe from which are evolved strong arm of steam shovel and deft fingers of the loom.

The laws of motion! You, my young friends, must have in some measure my own youthful view, which, to tell the truth, I have never wholly lost, that there is something absurd in the idea of reducing the more complicated phenomena of nature to an orderly system of mechanical law. For, to speak of motion is no doubt to call to your minds first of all the phenomena that are associated

¹ Speaking of catching things reminds the writer of a catfish he once saw gasping for air in water that had been muddied by the opening of a sluiceway in a dam. The boy swam up behind the fish, jammed a hand into each gill, and pushed the fish ashore; and it weighed 36 pounds! Once the writer, rowing around a sharp bend in a stream, saw a sandhill crane stalking along the shore; into the water went the boy, with the suddenly conceived idea that he could catch that crane, and, swimming low, he reached the shore about 20 feet from the bird, jumped quickly out of the water, made a sudden dash, and the bird was captured! A friend of the writer named Stebbins once followed his dog in a chase after a jack rabbit. The rabbit made a wide circle and came back to its own trail some distance ahead of the dog, made a sidewise jump, and sat looking at the dog as it passed by, so intently indeed that Stebbins walked up behind the rabbit and caught it with his hands.

with the excessively complicated, incessantly changing, turbulent and tumbling motion of wind and water. These phenomena have always had the most insistent appeal to us, they have confronted us everywhere and always, and life is an unending contest with their fortuitous diversity which rises only too often to irresistible sweeps of destruction in fire and flood, and in calamitous crash of collision and collapse where all things mingle in one dread, fluid confusion.¹

The laws of motion! When I was a boy I read many scientific books with great interest, but I never could quite reconcile myself

¹ "The subtlety of Nature is far beyond that of sense or of the understanding; so that the specious meditations, speculations and theories of mankind are but a kind of insanity" [Novum Organum, bk I, § X].

There is at the present time a general awakening in philosophy and many scientific men seem to think that the world-wide talk on pragmatism is simply the first, long-delayed response of the great mass of men to the compelling philosophy of the experimental sciences, but it seems to the writer that this is by no means a complete diagnosis of the situation because some of the most striking features of the present philosophical movement are to be found in the transformation or reversion which the philosophy of the exact sciences is now undergoing. A period of remarkable activity in the physical sciences has been followed by a revolution in the conduct of business and industry, impressing the methods of the physical sciences upon great numbers of men, and the reciprocal effect is a growing domination of the exact sciences by a spirit of humanism, as pragmatism has been called in England. Indeed the changes which human interests as a whole are creating in the philosophy of the exact sciences are no less profound and significant than the changes which the physical sciences have brought about in the conditions of human life.

The change which is taking place in the philosophy of the exact sciences is many sided, but a prominent feature of it is the passing away of an old point of view, namely, that nature is exact and unvarying, that the so called laws of the physical sciences are ultimate realities, and that great simple facts of the physical universe are revealed in their perfection, one after another, to the divining spirit of mankind. It is not easy, however, to characterize the point of view which is now becoming dominant. In one way it may be described as a reenthronement of sense, and it may be exemplified by contrasting the introductory articles on hydraulics in Franklin and MacNutt's *Elements of Mechanics*, pages 218-25, with the point of view of the author of one of our best modern engineering treatises on hydraulics as indicated by the following extract: "Galileo said in 1630 that the laws *controlling* the motion of the planets in their celestial orbits were better understood than those *governing* the motion of water on the surface of the earth. This is true today, for *the theory of the flow of water in pipes and channels has not yet been perfected.*" [Italics ours] No! and it never will be Perfected! It would take too long to explain here just what is meant by this declaration for indeed it has nothing to do with the fool idea, if indeed it can be called an idea, that "the finite can not comprehend the infinite" so that "we may not presume to point out all the ways in which a God of unbounded resources might govern the universe." From such inanity may the great God of little things deliver us!

Every student should realize two things in connection with the study of the physical sciences. The first is that the study of the physical sciences is exacting beyond all compromise, and the second is that the completest science stands abashed before the infinitely complicated array of phenomena of the material world except only in the assurance which its method gives.

to a certain arrogant suggestion of completeness and universality. The laws of motion! My young friends, the science of mechanics is circumscribed in utter repudiation of such universal phrase; and yet curiously enough the ideas which constitute the laws of motion have an almost unlimited extent of legitimate range, and these ideas must be possessed with a complete precision if one is to acquire any solid knowledge whatever of the phenomena of motion, especially in the realm of devices which so serviceably accomplish the purposes of the human will, for in this realm, at least, everything is really and adequately correlated in a closely woven fabric of reason.

The necessity of precise ideas. Herein lies the impossibility of compromise in the teaching of the physical sciences and the necessity of constraint; one must think so and so, there is no other way. And the realm of precise ideas, that is the region I intended to symbolize by the land whereon the little Mexican tadpole, the axolotl, is forced to live by unwelcome stress of weather. I remember as a boy a sharp contest in my own mind between an extremely vivid sense of things physical and the constraining function of precise ideas. This contest is perennial, and it is by no means a one-sided contest between mere crudity and refinement, for refinement ignores many things. Indeed, precise ideas not only help to form our sense of the world in which we live, but they inhibit sense as well, and their rigid and unchallenged rule would be indeed a stress of dryness.

The laws of motion! I return again and yet again to the subject, for indeed I am not to be deterred therefrom by any concession of inadequacy, no, or by any degree of realization of the vividness of your youthful sense of those things which, to suit my narrow purpose, must be stripped completely bare. It is unfortunate however for my purpose that the prevailing type of motion, the flowing of water and the blowing of wind are useless as a basis for the establishment of the simple and precise ideas which are called the laws of motion and which are the most important of the fundamental principles of physics. These ideas have in fact grown out of the study of the simple phenomena which are associated with the motion of bodies in bulk, without perceptible change of form, the motion of rigid bodies, so called; and these ideas are limited in their strict application to these simple phenomena.

Before narrowing down the scope of my discussion, however, let me illustrate a very general application of the simplest idea of

motion, the idea of velocity. You all have, no doubt, an idea of what is meant by the velocity of the wind, and a sailor, having what he calls a 10 knot wind, knows that he can manage his boat with a certain spread of canvas and that he can accomplish a certain portion of his voyage in a given time; but an experienced sailor, although he speaks glibly of a 10 knot wind, belies his speech by taking wise precaution against every conceivable emergency. He knows that a 10 knot wind is by no means a sure or a simple thing, with its incessant blasts and whirls; and a sensitive anemometer, having more regard for minutiae than any sailor, usually registers in every wind a number of almost complete but excessively irregular stops and starts every minute, and variations of direction that sweep round half the horizon!

We must, as you see, direct our attention to something simpler than the wind. Let us therefore consider the drawing of a wagon or the propulsion of a boat. It is a familiar experience that effort is required to start a body moving, and that continued effort is required to maintain the motion. Certain very simple facts as to the nature of this effort, as to the amount of effort required to produce motion, and as to the conditions determining the amount of effort required to keep a body in motion were discovered by Sir Isaac Newton and these facts are called the laws of motion.

The effort required to start a body or to keep it moving is called force. Thus if I start a box sliding along a table, I am said to exert a force on the box. I might accomplish the same effect by interposing a stick between my hand and the box, in which case I would exert a force on the stick and the stick in its turn would effect a force on the box. We thus arrive at the notion of force action between inanimate bodies, between the stick and the box in this case, and Newton pointed out that the force action between two bodies A and B always consists of two equal and opposite forces. That is to say, if body A exerts a force on B, then B exerts an equal and opposite force on A, or, to use Newton's words, "Action is equal to reaction and in a contrary direction."

I might have led up to a statement of this fact by considering the force with which I push on the box and the equal and opposite force with which the box pushes back on me, but if I do not wish to introduce the stick as an intermediary, it is much better to speak of the force with which my hand pushes on the box and the equal and opposite force with which the box pushes back on my hand, because, in discussing physical things, it is of the utmost importance to



cant an operation? There is, indeed, an extremely important matter involved here which we will consider when we come to the discussion of work and energy; but it has no bearing on the matter of the balance of propulsion and drag on a body which moves steadily along a straight path.

Let us now consider the relation between the forces which act upon a body which is changing its speed, upon a body which is being started or stopped, for example. I suppose that you have noticed how a mule strains at his rope when starting a canal boat, especially if the boat is heavily loaded, and how the boat continues to move for a long time after the mule ceases to pull. In the first case, the pull of the mule greatly exceeds the drag of the water, and the speed of the boat increases; and in the second case, the drag of the water exceeds the pull of the mule, for the mule is not pulling at all, and the speed of the boat decreases. When the speed of a body is changing, the forces which act on the body are unbalanced; we may conclude that the effect of an unbalanced force acting on a body is to change the velocity of the body; and it is evident that the longer the unbalanced force continues to act the greater the change of velocity. Thus if the mule ceases to pull on a canal boat for one second, the velocity of the boat will be but slightly reduced by the unbalanced drag of the water, whereas if the mule ceases to pull for two seconds the decrease of velocity will be much greater. In fact the change of velocity due to a given unbalanced force is proportional to the time that the force continues to act. This is exemplified by a body falling under the action of the unbalanced pull of the earth; after one second it will have gained a certain amount of velocity (about 32 feet per second), after two seconds it will have made a total gain of twice as much velocity (about 64 feet per second) and so on. Furthermore, since the velocity produced by an unbalanced force is proportional to the time that the force continues to act, it is evident that the effect of the force should be specified as so much velocity produced per second, exactly as in the case of earning money; the amount one earns is proportional to the length of time that one continues to work, and we always specify one's earning capacity as so much money earned per day.

Every one knows what it means to give an easy pull or a hard pull on a body. That is to say, we all have the ideas of greater or less as applied to forces. Everybody knows also that if a mule pulls hard at a canal boat, the boat will get under way more quickly than

if the pull is easy, that is, the boat will gain more velocity per unit of time under the action of a hard pull than under the action of an easy pull. Therefore, any precise statement of the effect of an unbalanced force on a given body must correlate the precise value of the force and the exact amount of velocity produced per unit of time by the force. This seems a very difficult thing, but its apparent difficulty is very largely due to the fact that as yet we have not agreed as to what we are to understand by the statement that one force is precisely three, or four, or any number of times as great as another. Suppose, therefore, that we agree to call one force twice as large as another when it will produce in a given body twice as much velocity in a given time (remembering of course that we are now talking about unbalanced forces, or that we are assuming for the sake of simplicity of statement that no dragging forces exist). As a result of this definition we may state that the amount of velocity produced per second in a given body by an unbalanced force is proportional to the force.

Of course we know no more about the matter in hand than we did before we adopted the definition, but we do have a good illustration of how important a part is played in the study of science by what we may call making up one's mind, in the sense of putting one's mind in order. This kind of thing is very prominent in the study of elementary physics, and by that rather indefinite reference, in my story of the little tasseled salamander to an inward growth so needful to you before you can hope for any measure of success in our modern world of scientific industry, I meant to refer to this thing, the "making up" of one's mind. Nothing is so essential in the acquirement of exact and solid knowledge as the possession of precise ideas, not indeed that a perfect precision is necessary as a means for retaining knowledge but that nothing else so effectually opens the mind for the perception even of the simplest evidences of a subject. Opens the mind, that is, for those things which are conformable to or consistent with the ideas. The history of science presents many cases in which accepted ideas have closed the mind to contrary evidences for many generations. Let young men beware!¹

¹This ends the abstract from the lecture to the older scholars of the Bethlehem schools.

The study of physical science considered as a transformation of the mind

To teach the physical sciences effectively is, I believe, to completely transform the mind of a young man, and I think that this transformation is a reorganization of the rich materials of the primitive mind of a boy. Every one is, of course, familiar with the life history of a butterfly, how it lives at first as a caterpillar and then undergoes a complete transformation into a winged insect. It is of course evident that the bodily organs of the caterpillar are not at all suited to the needs of the butterfly, the very food (of those species which take food) being entirely different. As a matter of fact, almost every portion of the bodily structure of the butterfly is dissolved, as it were, into a formless pulp at the beginning of the transformation, and the organization of a flying insect then grows out from a central nucleus very much as a chicken grows in the food stuff of an egg. So it is in the development of the modern mind. In early childhood, if the individual has been favored by fortune, he exercises and develops more or less extensively the primitive instincts and modes of the race in a free, outdoor life, and the result is so much mind stuff to be dissolved and transformed with more or less coercion and under more or less constraint into an effective mind of the 20th century type.

Nothing is more completely established in psychology nowadays than that ideas can not be formed out of the clear sky, as it were. They must be built of stuff, and the rational study of the physical sciences especially in its earlier stages is the transformation of simple intimate knowledge into general ideas. All elemental knowledge, such as the knowing how to throw a ball, how to ride a bicycle, how to swim, or how to use a tool, is locked in the marginal region of the mind (the region of reflexes) as a very substantial but very highly specialized kind of intuition, and the problem of the teaching of elementary physical science is the problem of how, by verbal and concrete suggestion, to drag this material into the field of consciousness¹ where it may be transformed into a generalized logical

¹ The writer has had an experience in these matters which, he believes, is very unusual. Every attempt he has ever made to develop muscular skill, as in playing ball or tennis, has seemed to be disturbed by a sort of meddling consciousness. He remembers the attempt made in 1875 to learn manual telegraphy, in which a brother and a sister became expert, whereas his own sending was always spasmodic and uncertain in character, and never for a moment free; and the same has always been true of his ball and tennis playing. But the instincts of a fish! These seem to be deeply seated indeed, for the writer has never seen the person to whom he would yield in the matter of swimming!

structure having traffic relations with every department of the mind. An abstract treatment of the principles of elementary physics, tends more than anything else, to inhibit the influx of this elemental knowledge from the marginal regions into the field of consciousness and results in the building up of a theoretical structure which can have no effectual traffic with any mental field beyond its own narrow boundaries. Such a state of mind is nothing but a kind of idiocy, and to call it a knowledge of elementary science is weak scholasticism.

There are in my opinion two chief errors prevalent among teachers of the physical sciences, an error of assumption and an error of perversion, and I will explain each in terms of an example. A short time ago a friend of mine, in speaking of his method of discussing the subject of sliding friction in class, said that he placed on the blackboard a sketch of a block resting on a moderately smooth plane and then asked the class to consider the force necessary to move it up or down. Now, I have found it possible to use, in class discussion, a student's experience of a severe jerk when he boards a rapidly moving car, his experience of the great effort required at the starting of a heavy boat, his experience of the steady pull required to keep a boat in motion, and many other elemental experiences of this kind; but I have found that the utterly confused experiences which every man has as to the opposing forces which act upon solid bodies when starting or when in motion, make it impossible to bring a simple case like the above into the mind of the student by any amount of verbal suggestion. I believe that any discussion of the approximate laws of friction between moderately smooth bodies must be based upon an actual experiment by the student carried out under the very simple conditions as specified. The very simple experience which it is desired to use in this case is hopelessly involved among the infinitely complicated and variable experiences which men have as to the obstruction of motion or solid bodies. It is a serious mistake in the teaching of elementary physical sciences to assume a specialized form of experience on the part of the student. Elemental experience exists in superabundance, specialized experience is rare.

Some time ago an incident occurred in the classroom of one of our best teachers of mathematics who is charged also with the teaching of elementary mechanics. The subject of projectiles being up for discussion, a rather stupid student was called sharply to account with the question, "What is a projectile, anyway?"

"Would you be a projectile if I were to pitch you out of the window?" "Yes," replied the young man hesitatingly, and he was met with the instant response "No, you wouldn't. A projectile is a material particle." Now, a material particle is nothing but an idea, and it stands for our agreement with ourselves to consider only the translatory motion of the body we are studying. It is very desirable indeed to express ideas in objective terms as if the ideas existed physically, thus we speak of the material particle, of the rigid body, of the perfectly elastic solid, of the frictionless incompressible fluid, of the perfect gas, of the atom, of the molecule, and so on. Helmholtz says, indeed, that "It is a great advantage for the sure understanding of all abstractions if one seeks to make the most concrete possible pictures of them." The use of objective terms in speaking of abstractions, however, is apt to bring about that confusion of boundaries between our logical structures and the objective realms of reality, which, according to Münsterberg, is the gravest danger of our time, and there can be no doubt but that one of the greatest errors in the teaching of the elementary physical sciences is precisely this confusion of boundaries. Ideas must be recognized as ideas, and their application must not be totally inhibited by our thinking of them as the things to which they themselves apply. The idea of a material particle is applicable to any material system, however complicated, however turbulent, for, in fact, we may, if we choose, direct our attention to the translatory motion of such a system. If one were to twirl a wriggling eel in a circular path at the end of a length of fish line, one would find the idea of a material particle useful in describing certain aspects of the motion, although the behavior of an eel under the pushing and pulling efforts of a fisherman to disengage it from the hook, does, I admit, transcend the idea of a material particle.

"Our method," says Bacon, "is continually to dwell among things soberly, without abstracting or setting the mind further from them than makes their images meet," and, "the capital precept for the whole undertaking is that the eye of the mind be never taken off from things themselves, but receive their images as they truly are, and God forbid that we should offer the dreams of fancy for a model of the world."

In order that I may be able to specify in a general way what it is that is to be built up in the mind of a young man by the rational study of the physical sciences, let me distinguish two chief results of the scientific activity of the last half century, namely, (1) an accumulated mass of fact, under which heading I would include all

of the details of applied science, for indeed the most important and compelling facts that have been accumulated by the sciences are the facts which are incorporated in the settled doings of men; and (2) an established mode of thought and inquiry which may be designated, using a suggestive phrase of Bacon's, as "A new engine, or a help to the mind corresponding to tools for the hand."

We continually force upon the extremely meager data obtained directly through our senses an interpretation which in its complexity and penetration would seem to be entirely incommensurate¹ with the data themselves, and we exercise over physical things a kind of rational control which transcends the native cunning of the hand. The possibility of this forced interpretation and of this rational control depends upon the use of two complexes, (a) a logical structure, that is to say, a body of mathematical and conceptual theory which is brought to bear upon the immediate materials of sense, and (b) a mechanical structure, that is to say, either (1) a carefully planned arrangement of apparatus such as is always used in making measurements, or (2) a carefully planned order of operations such as the successive operations of solution, reaction, precipitation, filtration and weighing in chemistry.

These two complexes do indeed constitute a "new engine" which helps the mind as tools help the hand; it is through the operation of this engine that the interpretations and control of the physical sciences are made possible; and the study of elementary physics is intended to lead to the realization of this new engine (1) by building up in the mind the logical structure of the physical sciences, (2) by training in the making of measurements and especially in the performance of ordered operations, and (3) by exercises in the application of these things to the actual phenomena of physics and chemistry at every step and all the time with every possible variation.

¹ For example an astronomer listens to the beats of a clock as he watches a spot of light move across the field of a transit circle, noting the time of transit across the middle cross hair, and then he notes the reading of the divided circle. This he does three times in succession, and from this data he determines the orbit of the spot of light (a comet) around the sun, predicting when it will come nearest to the sun and how far away it will be, when it will return, and so on. The chemist can see the color of a solution of precipitate and he can perceive its odor and taste, and above all he can weigh it, but he can not do much besides, and any one who is familiar with the results of organic chemistry, as represented in the modern language of the present, must realize that they are little short of a miracle. The same is true of botany, zoology, and other sciences. The results of these sciences are not only so far removed from the senses as to be almost entirely beyond the grasp of the senses, but they are also so far removed from the senses as to be almost entirely beyond the grasp of the senses.

The process of building up the logical structure of the physical sciences is very largely the rehabilitation of the sensuous elements of the mind in relations which are continuously new. The possibility of this process has grown up as a human faculty almost solely on the basis of language. Definite parts of the sensuous content of the mind become fixedly associated with definite words, and the reapplication of old words on the sliding scales of similitude and analogy, rehabilitates the old materials of the mind in ever widening relations. But a large part of simple theoretical physics is constructed out of sensuous elements which are not habitually and fixedly associated with verbal forms of expression, and it is impossible to marshal these elements in any other way than by direct appeal, by sight or feeling, to the actual things which correspond to them. I refer here to the purely mechanical aspects of elementary physics, and to the degree to which a mechanical sense forms the basis of the logical structure of the whole of physics and chemistry. Most men seem to imagine indeed that a physical theory is a vague sort of analogy between strongly anthropomorphic ideas and hazy generalities of things, but the fact is that a physical theory comes very near indeed to being a mechanical model or a machine. The molecular theory in chemistry, for example, is as truly a mechanism as a locomotive, except that a locomotive must be actually constructed to be used, whereas the molecular theory need only be imagined. Let no one suppose, however, that it is as easy to imagine the molecular theory as it is to build a locomotive!

The notion seems to be widely prevalent that the logical structure of the physical sciences is a structure of mathematical functions and formulas; but geometrical and especially mechanical ideas and conceptions completely dominate the physical sciences from beginning to end. Arithmetic, including algebra and calculus, is important in working from given data to numerical results, but the argument is in every case mechanical or geometrical, and without geometrical and mechanical ideas physical theory becomes absolutely sterile. Mathematics to most people means numbers, and the lack of appreciation, in many quarters, of the tremendous importance of geometry and mechanics — the picture book of the physical sciences which is too little perused — seems to be due to the fact that the idea of number, of all impersonal ideas, has obtained by far the strongest hold on the human mind. Deeply ingrained in every human being is the feeling that number relates to actual things, fish, or beads, or cattle, or dollars, and to my mind the most re-

markable fact connected with the teaching of the physical sciences is that it is so very easy to cheat young people into the belief that a study relates to something real if it involves arithmetic. I believe indeed that one of the most serious perversions in the teaching of the elementary and advanced physical sciences is that which is involved in the assignment of great numbers of problems which are more or less completely detached from actual physical things or which involve data the determination of which is not within the range of the student's knowledge or experience. "Natural philosophy is not yet to be found unadulterated, but is impure and corrupted . . . by mathematics, which ought rather to terminate natural philosophy than to generate or create it." [Novum Organum, bk I, § XCVI]

Concerning a course in physics for the secondary school

The most important thing, I should say, for the successful teaching of physics in the secondary school is that ample opportunity be given for every variety of play, including swimming and skating, and, wherever possible, boating. It is ridiculous to attempt to teach physics, or anything else for that matter, without the substantial results of play to build upon. Playgrounds are the cheapest and in many respects the best of schools, but alas they are almost entirely lacking in many of our towns which have grown to cities in a generation in this great "Nation of Villagers." The boroughs of Bethlehem, for example, (for we have a kind of virtue in not pretending to be a city), have no playground connected with a public school, nor any other public place where boys can play ball.

WHAT DO YOU THINK?¹

We, the editors, have been dragged along back alleys, across open sewers, and through rank growths of weed and thistle to view the Monocacy meadows to consider the possibility of their use as a playground or park. We are not much impressed with the proposal, the place is apparently hopeless, but the park enthusiasts could not be touched by argument. To our very practical objection that the cost would be excessive he made the foolish reply that there is no cost but a saving in using what has hitherto been wasted. To our expressed disgust for the open sewers and filth he replied that that was beside the question, for, as he said, we must sooner or later take care of the filth anyway. But, we said, the creek is contaminated above the town,² very well, he replied, we have the right to

¹ This and the following communication are from a small paper, printed and published by two Bethlehem boys.

² There are in fact several water mills above the town, and any one who knows the secrets of a small water mill knows what that means!

prohibit such contamination. And worst of all, in double meaning, was his instant agreement to our statement that we had our cemeteries which, he said, were really better than any Bethlehem park could be.

COMMUNICATION

Dear Editors: I took a walk along the Monocacy creek on Sunday after noon and discovered clear water several miles above town and a fine skating pond; but I suppose that you and all of your subscribers will have to go to our enterprising neighbor, Allentown, to find any well kept ice to skate on this winter. Most people think that you boys can swim in nature's own water, skate on nature's own ice, and roam in nature's own woods, but it is absolutely certain that your elders must take some care and pains if you town boys are to do any of these things, and yet, here in the East, children are said to be brought up (implying care and pains) and hogs are said to be raised (implying only feeding). I thank the Lord that I was "raised" in the West where there are no such false distinctions.

Your subscriber S.

P. S. As I came home covered with beggar-lice and cockle burrs, I saw a ring of fire on South mountain, an annual occurrence which has been delayed a whole week this autumn by a flourish of posters in several languages offering One Hundred Dollars Reward!

S.

Knowing my interest in parks and playgrounds, the local editor of a real, steam engine newspaper asked me kindly to write him a communication, and, not knowing how to do so formal a thing, I sent him the following which he considerately published with the exception of the last sentence.

To the Editor of _____

What can be charged against a community like the Bethlehems as more indicative of that dreadful carelessness, the common neglect of children, than that there is no fit place for our boys to swim? Oh yes, there is one really fine place, as I know from experience, and there is nothing I would like so much to do as to turn Pied Piper and lure the entire brood of Bethlehem boys and girls to Friedensville¹ and into that awful chasm of crystal water to come back no more, no, not even when an awakened civic consciousness (my! how some people do like that word!) had made a park of the beautiful Monocacy meadows and converted the creek into a chain, a regular Diamond Necklace of swimming holes. I beg the garbage men's (*not* a printer's error for man's) pardon for speaking of the beautiful Monocacy meadows. I refer to what has been and to

¹ The peaceful site of an abandoned zinc mine where sheer walls of rock surround a three-acre pool of perfectly clear cool water, hundreds of feet in depth.

what might easily continue to be. As for the Diamond Necklace, that of course would have to be above the Gas Works where the small stream of *pure* tar now joins the main stream.

There, Mr Editor, is your communication.

S.

It seems utterly foolish to talk of teaching elementary physics (for I must stick to my subject) to boys who live in towns like Bethlehem, and yet we are no worse than some of the neighboring villages, Philadelphia and New York, for instance! We boast of having conquered nature; well, we have now got to domesticate the wild thing before much else can be done in this country of ours! We have got to do it, and it is foolish to talk of teaching physics, to people who fail to realize this fact. I suppose that I am as familiar with the requirements of modern industry as any man living and as ready to tolerate everything that is economically wise, but every day as I walk to and fro I see the Monocacy creek covered with a scum of tar, and in crossing the river bridge I see a half mile long heap of rotting refuse serving the Lehigh as a bank on the southern side; not all furnace refuse either by any means, but nameless stinking stuff cast off by an indifferent population and carelessly left in its very midst in one long unprecedented panorama of putrescent ugliness! And when on splendid autumn days the near-by slopes of old South Mountain lift the eyes into pure oblivion of these distressing things, I see anon a line of fire sweeping through the scanty woods. This I have seen every autumn since first I came to Bethlehem.

It is easy to speak in amusing hyperbole of garbage heaps and of brooks befouled with tar, but to have seen one futile flourish of posters on South Mountain in eleven years! that is beyond any possible touch of humor. It is indeed unfortunate that our river is not fit for boys to swim in, and it is not, for I have tried it, and I am not fastidious either, having lived an amphibious boyhood on the banks of the muddiest river in the world; but it is a positive disgrace that it is not fit to look at,¹ that it is good for nothing whatever but to drink, much too good, one would think, for people who protect the only stretch of woodland that is accessible to their boys and girls by a mere flourish of posters!

¹ At the end of one of our main bridges is a hotel with an omnibus chute behind, and there it stands, a brazen paralyzed brute, heaping its dung forever!

Wh—a—a—t I h-h-ave said concerning the complete transformation of the mind of a boy by science study, refers to the final result after school and college, and of course the character of the elementary science instruction in the secondary school is not to be determined wholly by such philosophy as I have attempted to set forth. Transformation means the change of something into something else, not the making of something out of nothing; and what this original something is and how to get hold of it so as to change it into something else are no less important than a clear idea of what you wish to convert the original thing into. How is the science teacher to get hold of the primitive mind of a boy? That is the question. And you will please understand that in considering this question I have not the least desire to relieve the boy from coercion. It is not a question of ease and pleasure but solely a question of effectiveness.

In the past the scientist in his capacity as teacher, has had to assume the role of magician to a greater or less extent.

When old Sir Henry Wotton was sent as ambassador "to *lie* abroad" (as he wittily called it, to his cost) in a piece of business relating to a brief Bohemian kingship that was fated soon to explode at the battle of Weissenberg in 1620, he saw at the city of Linz, in the picturesque green country by the shores of the Danube, there, an ingenious person who is now recognizable as one of the remarkablest of mankind, Mr John Kepler, namely: Kepler as Wotton writes him, addressing the great Lord Bacon on that among other subjects. Mr John's now ever memorable watching of the motions of the planet Mars with "calculations repeated seventy times," and his discovery of the planetary laws of this universe some ten years before appear to be unknown to Wotton; but there is something else of Mr John's devising which deserves the attention of the Instaurator¹ of Philosophy: "He hath a little black tent" says the ambassador, "which he can suddenly set up where he will in a field; and it is convertible (like a windmill) to all quarters at pleasure; capable of not much more than one man, as I can see, and perhaps at no great ease; exactly close and dark, save at one hole about an inch and a half in diameter to which he applies a long perspective trunk with the convex glass fitted to the said hole, and the concave taken out at the other end, which extendeth to about the middle of this erected tent: through which the visible radiations of all the objects without are intromitted, falling upon a paper, which is accommodated to receive them; and so he traceth them with his pen in their natural appearance, turning his little tent round by degrees until he hath designed the whole aspect of the field." In fact, he hath a *camera obscura* and is exhibiting the same for the delecta-

¹ Bacon himself called his *Advancement of Learning* and his *Novum Organum*, his Great Instauration, hence Carlyle's reference to him as the Instaurator of Philosophy.

tion of imperial gentlemen lounging that way. Mr John invents such toys, writes almanacs, practices medicine, for good reasons, his encouragement from the Holy Roman Empire and mankind being only a pension of 18 pounds a year, and that hardly ever paid. An ingenious person truly, if there ever was one among Adam's posterity. Just turned of 50 and badly-off for cash.

The temper of the world, however, is fast becoming such that there is no need of nor even toleration for the magic element in science. Every one is beginning to recognize the tremendous importance of the physical sciences in everyday life, and it is now possible for a teacher of the elementary physical sciences to devote himself to a homely study of the things which are more or less familiar to every boy. The possibility of this kind of elementary science study is perhaps the most important fact to be reckoned with in connection with the teaching of the elementary physical sciences in the secondary school, but there is still a very serious difficulty which I can explain with the help of an example. A few weeks ago I gave an experimental lecture at a distance from Bethlehem. I was obliged to carry a delicate piece of apparatus with me in the train, and I was greatly amused when a fellow asked facetiously if I was carrying "a new-fangled contrapshun for catching chickens." A good-natured laugh satisfied the fellow, of course, but I could not help thinking that his question indicated about where I would have to begin to explain the thing to him. A great difficulty in the teaching of the physical sciences is that the human mind, intuitively habituated as it is to consider the immediate practical affairs of life, can hardly be turned to that minute consideration of apparently insignificant details which is so necessary in the scientific handling even of the most distinctly practical problems. I believe that this quality of detachment, which is an especially prominent feature of nearly every fundamental principle of physical science, must be seriously reckoned with in any attempt to formulate a practical course of instruction in elementary physics in the secondary school.

Some time ago I was talking with my own boy about his physical laboratory work in school, and I was greatly interested in his expression of contempt for a piece of work he had done, namely, the determination of the force required to break a wire. Just picture to yourselves how contemptible a teacher would be in the eyes of a wild Indian whom he had set at such work, and my boy is indeed a kind of a wild Indian. Suppose it does take so much force to break a wire, and suppose you do divide this force by the sectional

area of the wire. What in the name of all that is real does it mean to a boy? But if you make use of this experimental result as a basis for enabling a boy to estimate the number of locomotives of one hundred tons each that could be supported by the Brooklyn bridge, and this particular problem is simple enough for any boy to handle, then the whole aspect of the matter would be changed, and the boy would begin to be differentiated from a genuine wild Indian. Suppose, however, that the teacher does not relate the experiment with the wire to some significant condition or thing, then most assuredly he would deserve the contempt that any boy would have for him, and if you know boys at all, you must know that capacity for contempt is one of their strong points.

It was Lord Kelvin, I believe, who made a statement many years ago to the effect that when we can measure a thing we know all about it, and it seems to me that the most widely approved high school course in elementary physics at the present day is in accord with a literal interpretation of this statement of Lord Kelvin's; but my experience is, most emphatically, that a student may measure a thing and know nothing at all about it, and I believe that the present high school courses in elementary physics in which quantitative laboratory work is so strongly emphasized are altogether bad. Quantitative laboratory work has pedagogical value in conjunction with classroom work which is devoted to the advanced mathematical theory of the physical sciences, but I believe that the only quantitative physical laboratory work that should be given in the secondary school is that which can be justified by the practical value of measurement in everyday life and business, and that which relates to things of which the boy has some intimate knowledge independently of what is brought to him by the laboratory work itself. Let a boy determine the velocity of a runner by observing the time required to run a measured distance; let the power that can be developed by a boy be determined by observing the time required for him to climb a measured flight of stairs (any healthy boy of 16 years can develop a horse power and a quarter); let a boy estimate the length of his normal walking step by counting the number of steps in a measured distance; let the area of a lot in acres be determined by stepping off its length and its breadth; let a boy estimate the value of a piece of timber by measuring its dimensions, knowing the cost per thousand board feet; let the velocity of water in a nozzle be calculated from the measured volume of discharge in a known interval of time and the measured diameter of the

nozzle; let the pressure of gas in the city mains be determined by measuring the depression of water level in a glass tube connected to a gas cock; let the pressure of water in the laboratory supply pipes be estimated on the basis of Torricelli's theorem and the measured velocity at which the water issues from a small nozzle; if there is a canal near the school, let the boy measure approximately the velocity of the water in the canal by stepping off the distance traveled by a float in a known interval of time and then let him estimate the volume of water discharged per second by measuring the depth and width of the canal; let a boy determine the density of a variety of substances of regular geometrical form by weighing and measuring volumes; let him determine the specific gravity of wood by measuring the submerged length of a slim stick; let a boy determine rainfall by means of a simple rain gauge and let him record atmospheric temperature, wind direction, and degree of cloudiness for a period of a month; and so on. In short, let a boy get his own data for a great variety of simple numerical problems in the solution of which he may be supposed to have some interest because of knowledge independent of that which comes to him in the making of the measurements.

I believe that the physical sciences should be taught in the secondary school with reference primarily to their practical applications. The textbook should be devoted chiefly to the description and analysis of the more familiar practical applications of physics accompanied by many illustrations of actual devices and processes, and the laboratory work should be of the character suggested above. Such a course would be of the greatest value to young men who do not enter college, and it would furnish a most satisfactory basis for college work in the physical sciences.

I have recently followed the work of my own boy in a good preparatory school and a short time ago I helped him to get the "answers" to a group of problems under Newton's law of universal gravitation. The problems related to the mass of the sun and moon and to the weight of a body at a distance of thousands of miles from the earth! I have examined hundreds of young men in elementary physics many of whom had had a great deal of quantitative laboratory work concerning things they knew little or nothing about. They could talk ohms, and volts, and amperes, and focal lengths and images, and candle power, and what not; but I have never seen much evidence of that growth of simple intimate knowledge into general ideas which is the very essence of what should be accom-

plished in the study of elementary physics. More than half of the boys I have examined have been unable to tell the specific gravity of a stick knowing that it floated three quarters submerged in water, and I think it is no exaggeration to say that less than ten per cent of the boys have been able to calculate the specific gravity of oil when told that a stick floats three quarters submerged in water and seven eighths submerged in oil. One question which I have used many times in my examinations refers to the scheme of connections and to the principle of continuous vibration of the ordinary electric bell, and from my experience with this question and others like it, I am led to believe that the study of physics in our secondary schools does not accomplish the one thing which it may be expected to accomplish in the less familiar branches of physics, namely, to furnish an intimate knowledge of some few of the phenomena, a knowledge which is surely necessary before any attempt can be made to develop the general ideas of these branches of physics. I think that the laboratory work in these less familiar branches should consist almost entirely of manipulations approaching shopwork in character.

I do not insist on the study of the practical things in physics merely because of their practical value, although I believe that this consideration alone should determine the trend of all general instruction in elementary physics and chemistry, but I can not endure a so called knowledge of elementary science which does not relate to some actual physical condition or thing, and I believe that the only physical things that are sufficiently prominent in a young man's mind to be brought into the field of his science study are the things which have been impressed upon him in everyday life. Say what you will, you must do one of two things to be able to teach physics in any school; either you must create an actual world of the unusual phenomena of nature by purchasing an elaborate and expensive equipment of scientific apparatus, or, you must make use of the boy's everyday world of actual conditions and things. One of these things must be done; there is no other way.

Section B — BIOLOGY.

**THE EDUCATIONAL USES OF SHARKS AND RAYS, ESPECIALLY THE ACANTH
(*SQUALUS ACANTHIAS*, "HORNED DOGFISH")**

(Abstract)

BY BURT G. WILDER, CORNELL UNIVERSITY

Half a century ago students of vertebrate zoology and comparative anatomy dissected the human body and such animals as chance provided. During the last 30 years the desirability of selecting certain so called types or representatives of the several groups to be dissected in accordance with directions has become recognized. The choice of forms has varied greatly with localities, instructors and periods. Theoretic appropriateness and practical availability have sometimes conflicted.

As the outcome of 40 years of experience and reflection, and with increasing conviction as to the supreme importance of the early acquisition of some real knowledge of the brain, I submit the following proposition:

For the study of the structure, development, succession and relationships of vertebrates the best group to begin with is the selachians, the sharks and rays; if several forms can be studied the first should be — and if but one, that one should be — the acanth or "horned dogfish," *Squalus acanthias*.

Some of the points involved in the foregoing proposition have been discussed by me in Wilder and Gage's *Anatomical Technology*, pages 56–57, 1882; *Methods of Studying the Brain*, Cartwright Lectures before the Alumni Association of the College of Physicians and Surgeons of New York, *New York Medical Journal*, February 9, 1884, page 147; "The Desirability and the Feasibility of the Acquisition of Some Real and Accurate Knowledge of the Brain by Precollegiate Pupils," *Science*, December 17, 1897, page 903; "The Brains of *Scymnus* etc., with Remarks upon Selachian Brains for Standpoints Morphic . . . and Pedagogic," read at the annual general meeting of the American Philosophical Society, April 1905, *Science*, May 26, page 814; and "The Educational Uses of Certain Vertebrates and of Certain Vertebrate Brains," read (by title) before the section in general zoology of the Seventh International Zoological Congress, Boston, August

1907. Acanths of various ages may be had from dealers, especially the Supply Department of the Marine Biological Laboratory at Woods Hole, Mass., and the Harpswell Laboratory of Tufts College, Mass. Directions for dissection have been published by Prof. J. S. Kingsley (Henry Holt & Co.,) and Prof. L. E. Griffin of the Missouri Valley College, Marshall, Mo. With slight differences there apply also the portions relating to the "dogfish" of Europe in the *Practical Zoology* by the Parker Brothers (Macmillan Co.,) and by Marshall and Hurst (G. P. Putnam's Sons). Since this paper was read I learn from Prof. W. A. Locy of Northwestern University, that his course in comparative anatomy begins with the acanth.

Besides its purely zoologic uses the acanth may facilitate the solution of an educational and moral problem the importance and difficulty of which are forcing themselves upon parents, teachers and sociologists.¹ The following is based upon my rough notes of a lecture by Prof. Louis Agassiz in November 1867, the ninth of a course of 21 lectures upon selachians. Later he said he had tried to state what he regarded as very important facts concerning a delicate subject in such a way as not to disturb the women among the audience.

Unlike most of the lower vertebrates, with many kinds of sharks and rays the young are developed within the mother and the two sexes are easily distinguished by outward form. With the male the inner margins of the pelvic fins are prolonged and modified so as to constitute organs by means of which, while facing the female, the seminal liquid is introduced and internal impregnation is accomplished. These fishes are among the earliest vertebrates, yet their sexual relations were prophetic of conditions among the higher classes, among the mammals, and even with the other extreme of the series, the human species.

¹ Witness an article in *The Nature-Study Review* for November 1907, editorials in the *Ladies' Home Journal*, especially for January 1908, and the "Educational Pamphlets," 1-4, of the American Society for Sanitary and Moral Prophylaxis.

FIRST YEAR BIOLOGY IN NEW YORK CITY

BY ZILLAH HEIDENHEIM, CURTIS HIGH SCHOOL, STATEN ISLAND

You are all familiar with the requirements of the first year course in high school biology, embracing botany, zoology, and physiology as it is prescribed by the Board of Regents of the State of New York, and each has his convictions as to the conditions under which the work should be conducted and what its aim should be.

I desire to point out here, the conditions under which first year biology is taught in New York city, and to indicate briefly what the aim of the work conducted under these conditions must be.

Conditions. The first half of the year is devoted exclusively to botany, the second half to zoology and physiology. In some schools the second term is equally divided between the two latter subjects but in the majority the larger part of the time is devoted to zoology and only the necessary six weeks prescribed by the syllabus are given to physiology. In other schools, the human physiology and zoology are carried along together.

Each day is divided into six 45 minute periods. In most of the schools the biology teacher instructs during four of these, a fifth period is devoted to supervision in study hall or guard duty, leaving only one period free for preparation of the work. Sometimes this period is filled by assisting another in laboratory.

The size of classes varies with the locality of the school. Where the entering classes average five and six hundred the biology sections are of necessity very large, each class containing 35 or 40 pupils. A class of 18 or 20, which is as large as any biology class should be, is unheard of except in the smaller high schools of the city.

At present there is no high school which has not at least one good laboratory. Each of the newer schools is provided with several, well lighted and well arranged. One of these buildings in Brooklyn which is just about to open, contains five biology laboratories, each connected with a small room where all preparations are made. There is also an animal room and a conservatory in the building. It is intended that all the recitations shall be carried on in the laboratory, and practice may be substituted at any time for the recitation. This condition should exist in all the schools, and it is to be hoped that something may, in the course of time, be done to remedy the conditions existing in the older high schools,

where the number of pupils is so great that the single well equipped laboratory is far from adequate. In one of our largest high schools the zoology laboratory exercises are conducted in a cellar where the light is so poor that except on the brightest days it is impossible to work without artificial lights. All laboratory work carried on outside of the double laboratory period necessitates the carrying about of materials from room to room. The teacher is obliged to distribute material, give a lesson and again collect the material within the 45 minutes. The most capable teacher and enthusiastic pupil are handicapped under such conditions.

Some of the schools have a double laboratory period of an hour and a half, although several schools have two of these double laboratory periods and one recitation. In schools where it is customary to have one double laboratory period another single period is devoted to laboratory practice. It seems to be the general custom however, to have two recitations, and three laboratory periods of 45 minutes each.

Microscope. The laboratories are provided with compound microscopes. In most of the schools these are used by the pupil, although the time spent in the use of the microscope by the individual pupil during the year, varies from two 45 minute periods in one school to a full five weeks in another. The use of the microscope is indispensable to a comprehension of animal or plant structure and physiology, but its use by the pupil in the first year of high school is unwise, since the time spent in mastering the methods of handling the instrument can be more profitably devoted to other work and essentials can be taught by demonstration.

In all the laboratories a combination of the investigation and verification method are used. The investigation method is of course the more predominant since it brings out more fully the disciplinary value of the work, emphasizes the scientific method and develops that self-confidence and independence of thought and action in the pupil which are indispensable to successful work of any kind.

Three methods of keeping laboratory notes and drawings are in vogue. The most popular is the slip-sheet system. Notes and drawings are kept in a cover to which papers may be added or from which they may be withdrawn. This method seems the best as the books are of convenient size; the covers may be changed and poor work may be corrected and withdrawn. In other schools the drawings are kept in envelopes and the notes in a bound book. The third method is that of pasting drawings in a book in which the notes have been written.

Supplies are furnished by dealers in the city. Those for use in class are fairly good but rarely arrive at the right time. The teacher can usually obtain all that are needed. It is the exceptional principal who cuts down the supplies for economy's sake. These supplies include living and prepared material for class work as well as prepared material for demonstration, glass ware, and other apparatus. Anything can be obtained by ordering, provided the teacher is in no hurry to use supplies that are not on the regular list. We have recently been requested to limit our expenditures to 30 cents per pupil for the year. Most of us will find some difficulty in meeting this request.

In the city where the classes are large and the schools at a distance from the country, the field work is limited. The parks, museums, and aquarium, in New York and Brooklyn are, however, much used.

Aim. "The first year course in biology is designed to give students a general conception of the wide range of forms in animal and plant life; to lead them to observe the various processes carried on by plants and animals, and to study only so much of structure as is necessary for a clear comprehension of these processes, and to help them understand the general structure of the human body and the way to care for it."

One can readily see that the purpose quoted above from the syllabus of first year biology for high schools allows of much diversity in specific aim. This specific aim varies with the viewpoint of the individual teacher and is sometimes determined by the attitude of the principal toward the work. In each school, however, there is unity of aim, secured by departmental meetings. At these meetings all important questions are decided and teachers are kept in touch with one another's work. One of the schools emphasizes the economic aspect of the work, another the physiologic aspect, dwelling particularly on the human physiology, some emphasize the great diversity and range of plant and animal form and structure, trying to make scientists of the children.

Of the pupils who enter our high schools less than 20 per cent graduate, the greatest falling off occurs in the first year. This defection is attributed to various causes. Chief among these is the pupils' attitude toward the work. They dislike it, they find it too difficult, they feel that their high school work has no practical bearing on life.

In view of such conditions the biology teacher must first secure the interest of the pupil, and second fill the course with those facts and ideas which have the closest relation to everyday life. Professor Bigelow has said, "In teaching the elements of biology, we have yet to learn concentration on important and fundamental principles and to spend less time upon details of which organisms present unlimited variety." There is a general tendency to devote too much time to giving the pupil a conception of the range of forms and structure in animal and plant life, instead of emphasizing the important life processes. It is of far greater importance that the pupil should thoroughly understand the structure of some one form, and the way in which its organs function, and for this study I would recommend the frog, than that he should be familiar with a representative of each branch of the animal kingdom.

Teachers of science are apt to talk over the heads of beginners, forgetting that heretofore their mental pabulum has been predigested and doled out in small quantities. We can not make scientists of these children. Huxley has said: "You must not be too solicitous to fill the pupil with information, but you must be careful that what he learns he knows of his own knowledge. Pursue this discipline carefully and conscientiously, and you will make sure that however scanty may be the measure of information which you have pounded into the boy's mind, you have created an intellectual habit of priceless value in practical life."

Pupils are usually interested in those things which are useful and which have a bearing upon their immediate life. There are two other means of securing interest, which are not emphasized as much as they should be. The historical side of biology is entirely neglected. Very few of our pupils know anything of Darwin, Huxley, Agassiz, Gray, to say nothing of the discovery of the blood and the germ theory of disease. A boy who knows the difficulties placed in the way of the scientist as a result of superstition, and the ingenious methods used by them in their work, will realize that these men have discovered a new kingdom, have conquered a world of facts, and will feel that interest in their science which they have in the work of any hero who overcomes difficulties. The second point which I believe holds the pupil to this subject is turning his attention to some one branch and inducing him to make collections of insects or flowers or encouraging him in studying birds. A successful appeal to the pupil along one of these lines may arouse a lifelong interest in the work, whatever his vocation.

Our second aim we said was to fill the course with those facts and ideas which have the closest relation to everyday life. We must lay stress upon the importance of agriculture, the extermination of pests, medical plants, some time should be given to the study of the handling of food products and raw materials for manufacture, to the study of disease and sanitation. We must emphasize the study of the relation of all forms of life to man, point out the similarity of processes performed by all animals. For the rest we should make the work center about the physiology, limiting if necessary the forms studied to those one or two which show what the structure of the human body is like — sacrifice extent to content.

Recently the authorities have requested the biology teachers to make the work more interesting, more descriptive, and to take up less of the intimate structure of forms. The request emphasizes, I think, what has before been said, the tendency of the biology teacher to devote too much time to range of form and structure. Since our pupils leave in such large numbers during their first year, and some knowledge of life processes is essential to all human beings, this work in biology should remain where it is in the high school course, but we must limit our work to the mere requirements of the syllabus, and the capacity of the pupil, we must be satisfied with giving the pupil a knowledge of the essential facts in regard to a limited number of forms, together with those additions which I have suggested, namely directing the pupil's attention to making collections, interesting him in the history of the science, and making the humanistic side of biology the basis of our work.

EXPERIMENTAL WORK IN BIOLOGY

BY CYRUS A. KING, ERASMUS HALL HIGH SCHOOL, BROOKLYN, N. Y.

Read in absence of author

All will agree, even our worst enemies — the teachers of the classics — that the study of biology gives the pupil both knowledge and mental training. It matters not how poorly the subject is taught, both these results follow. This, however, is about as definitely as the outsider usually sees the results of our course, for this is, in many instances, what he himself is seeking to give his pupils. To the teacher of biology, this is scarcely an introductory aim. He knows that biology has a definite and special place in the high school course because, if rightly taught, it appeals to the pupil in a special way.

Not only must our work give knowledge, but it must, as far as possible, give *first-hand* knowledge. The textbook, the great desideratum in his other first year subjects, is in biology relegated to its proper place in the background and the pupil is required to study the plants and animals themselves. In other words, if our subject justifies itself from our own standpoint, it must derive its chief value from the fact that it is the one subject in his first year that carries the pupil, in a degree, away from his books and makes him study the things themselves. It is necessary for the success of the course that all the biology teachers in the State should be a unity, both theoretically and practically, as to the above conception. For not until we all give our courses so as to bring the laboratory side of the work into prominence, shall we meet with the respectful recognition that the subject deserves. The writer is not so unsophisticated as to assume that he is stating to his hearers a new conception of the biology course. He believes that there is pretty general agreement that the laboratory work should receive emphasis.

Too often, however, we can not in practice come up to our theoretical ideas of what should be done in the course. Even in our larger high schools this is difficult; in the smaller schools of the State, the overworked teacher, who may be required to teach other subjects besides biology, and, in addition, do enough clerical work for one person, has still less time to give to the preparation of his laboratory work. On the other hand, if the biology teacher

has a well equipped laboratory and wants to do the work in an approved way, he is confronted with a whole series of problems in working out a set of studies suited to the needs of his pupils.

To do the laboratory work well, the teacher must have thought through the course and adapted the studies of the various plant and animal forms used to the intellectual capacity of first year pupils. The course must give the pupils first-hand, definite information about some of the great biological processes that are going on in plants and animals. It must not degenerate into an elementary nature study course nor, neither in whole or in part, must it aim to prepare the pupil for a medical school.

As a result of all this pressure both from without and within, the teacher is often forced to follow the line of least resistance — to do that which requires the least energy and initiative — to substitute for laboratory work the study of the textbook, charts, and figures.

Whether or not the teacher takes time to do experimental work there is sufficient reason for using it at every available place if it visualizes the question to be considered and thus leads to clearness of conception; if the experiment is convincing when successfully carried out; if it develops originality and independence in the pupils who must think out, and in part, devise ways and means to do the experiment; and finally, if it gets a definite series of reactions from the pupils.

The writer has been doing experimental work in his botany classes during the past five years and regards it as an integral part of the work. Before requiring the pupils to do an experiment it is, in most cases, better, to discuss it in class. It must be clear that there is some question as to whether a certain organ really does perform a particular work; for example, the question as to whether or not the leaf gives off water vapor. After the question is stated to the class the teacher can then ask for suggestions as to how the pupils could prove whether or not leaves give off water vapor. If the question is too difficult for the pupils to answer at once, assign it for home work and have them write out additional suggestions for the next day. If the teacher can get the pupils to write out a series of statements that show how to prove the point, he has gotten a reaction from them, aroused interest, and excited their curiosity as to whether their respective theories of the way to prove the problem will work out in actual practice. Finally, as a result of this work, the pupils are better prepared to understand the experiment even though the teacher, in the end, performs it as a demonstration. In fact, some of the pupils will test their theories

of the more simple experiments before bringing them into class to be discussed and criticised. The teacher should remember, therefore, that one of the most important features of the experimental work is the discussion as to how the problem may be solved. It is only in this way that a certain element in each class will actually find out what it is all about. Criticisms and objections to various suggested plans for an experiment will enable these pupils to grasp more clearly the real question to be tested as well as the best means of testing it. It is only after the problem to be tested is clear, and the ways and means of testing it are evident that some of the sluggish, lazy pupils are willing to take the initiative and try the experiment as home work. However, as the teacher carries on the work, he can, by questioning, stir up the indifferent pupils and get from them, too, suggestions as to the way in which new experiments may be done.

It has been the writer's experience that the first year high school pupils soon become good critics of the fairness and accuracy of an experiment. Furthermore, they are, in general, readily taught to be honest in this work. They soon see the value of an honest control experiment and many of them will insist on one before they are willing to accept the evidence as shown by the experiment. Then, too, they are quick to recognize defective experiments even in our textbooks; the practical worthlessness of a conclusion drawn from attempting to grow but two seedlings, one of which has been mutilated, has been frequently pointed out to me by my pupils. With a minimum of a dozen of each kind of seedling the practical results of the experiment are certain to be more accurate and to the pupil will seem fairer.

It is often a stimulus to the experimental home work to have the pupils bring the experiment and the control to school. For this work, the pupil should receive an official mark because he must be made to feel that he has done, or at least has attempted to do, an integral part of the course. If the teacher is in doubt as to the genuineness of these home experiments, one or two detailed questions will usually decide the matter. As a rule, the pupils can do only the more simple experiments at home. Of these, a full series of observations and notes should be made and, in many cases it is well to ask for illustrations also. Other experiments requiring more apparatus should be set up under the teacher's direction in class and the pupils required to make sketches and notes to show that they understand what the experiment teaches. Finally, some of the experiments are done more satisfactorily during the regular

laboratory period. In these, too, the pupil must have a clear notion of the problem and of the reason for each step of the experiment. Otherwise many of the students will passively perform the experiment and not get its real significance.

We have found it a convenience for our pupils to arrange the experimental work into three classes, (*a*) laboratory work, (*b*) demonstrations, and (*c*) home work, with the understanding that the work in the first group is to be done by the individual pupils in the laboratory and is required of all; that the demonstrations are to be performed before the class by the teacher and by pupils with the teacher's help, and that these observations, notes and conclusions form a regular part of the work and are required of all pupils unless marked optional. Finally, it is understood that the home work experiments are required unless marked optional. The required home work must be written up in neat and logical form.

A simple device that has been of great practical service in the experimental plant work, particularly the home work, has been called for want of a better name a *pocket garden*. It is made in a variety of ways, but a very serviceable one may consist of two negatives, that have been cleaned, two pieces of black cloth the same size as the negatives and several pieces of blotting paper the size of the glass and cloth. After the seeds have been soaked, the pocket garden is made by putting the wet blotters together and the pieces of cloth on each side of them; the seeds, a half dozen or more are placed on the outside of each piece of cloth, and the glasses are put outside the seeds and fastened together at the two ends by means of string or elastic bands.

The pocket garden is now finished, and the student may watch through the glasses all the stages in germination of the various seeds which he has been asked to plant or cares to plant for himself. It is necessary to keep the interior moist, but if the garden is generously supplied with blotters it will maintain its moisture for several hours. We have had no difficulty whatever in keeping dozens of these gardens in the laboratory indefinitely by putting them on edge into a pan which contains some water. The black cloth is used because the parts of the young seedlings are usually white and the root hairs particularly, come out in sharp contrast on the black background.

These pocket gardens have been used in practically all the experimental work suggested in the State syllabus under seeds and seedlings, roots and stems, as well as in additional experiments not suggested by the syllabus.

To use a single illustration, suppose the pupil wants to find out whether or not the roots and stems of germinating seeds have a constant direction of growth with reference to gravity. Two gardens may be used and while one is kept in the same position the other may be shifted at all sorts of angles to see if there is any corresponding response in the direction of growth of the roots and stems of the half dozen young plants that are developing on each side of it. India ink marks on the glass may help to follow the migrating movements of these roots and stems.

The syllabus does not suggest experiments under flowers and fruits. It would, however, help to emphasize the function of the flower as a whole as well as of its stamens and pistils if the teacher should, as a demonstration, pollinate the flowers of a potted plant and compare the later development of these pistils with others like the Begonia, from which pollen has been excluded. If the pupils have already seen pollen under the microscope and have observed as a demonstration pollen tubes that have been germinated artificially, they are able to understand better the purpose of the pollen, of the stigma, and of fertilization with its bearing on seed production. Since the flower is usually studied chiefly for its taxonomic importance, it will be well to emphasize to the student its real purpose as well as the purpose of its parts.

In conclusion, too much attention can not be given to any work that will emphasize the fact that plants and animals are after all fundamentally alike; and that the same great biological processes are going on in both. For example, the pupil knows that digestion takes place within his own body, that he must be nourished, that he breathes by using up oxygen and giving off carbon dioxide, that there is a circulation of liquids going on within himself, that he is irritable and responds in definite ways to external stimuli and that his body is carrying on other vital processes, but it has never occurred to him that the same biological activities are going on in the plants about him.

While certain of these processes may be demonstrated more easily in plants and others in animals it should be shown as far as possible that they are all going on in both. We can not give our pupils any adequate idea of the real significance of these great principles if we do not emphasize them by experiment wherever there is an opportunity in the different forms studied. There are the important facts that make the year's course a unity and if they are brought out at every step, they are more certain to be understood at the end of the course.

Section C — EARTH SCIENCE

POWER QUESTIONS AND THEIR VALUE

BY JENNIE T. MARTIN, BUSINESS HIGH SCHOOL, WASHINGTON, D. C.

First, what do we mean by power questions? They are those which show how much mental food has been assimilated or how much intellectual muscle has been developed. In teaching physical geography I have had some experience with three classes of thought questions.

A Those whose answers depend upon known facts but which can not be found in textbooks.

B Those which are plausible in form but absurd in content.

C Original diagrams and maps to test knowledge of structure and development of physiographic features and the power of visualizing on the part of the pupil.

I will illustrate each of the three classes by actual questions and problems which I have used.

Under practical questions are the following:

1 Give the process by which the mica schist along Rock creek is being changed to clay.

2 Which is more useful for water power, the Potomac at Washington or Rock creek (a stream of high gradient) and why?

3 Why are the pebbles in the gravel beds about Washington, round and hard? What do they show about the origin of the beds?

4 What are the uses of the Potomac to the people of Washington?

5 Why is the clay of New York State better for crops than the clay of Virginia?

6 Why does the asphalt pavement sometimes bulge in summer? Why are so many repairs necessary in the spring?

Illustrating absurd questions are the following:

1 Why is the soil in the Mississippi flood plains about Cairo finer than it is at New Orleans?

2 Explain fully why so many volcanoes are found in the interior of Asia.

3 Why are caves commonly found in sandstone?

4 If a cyclonic storm center is at Buffalo, December 5, how many days later will it reach St Paul, Minn.?

5 Why is the weather so warm at the center of an anticyclone area?

The following list of test diagrams suggests their character.

1 Draw 5 diagrams illustrating as many stages in the development of a river valley.

2 Draw 5 diagrams illustrating the successive changes in the divide between two rivers that develop from youth to old age.

3 Draw 5 stages in the formation of a cavern.

4 Draw a map of a hill drained by five rivers. (Use shading, hachures or contours).

Draw:

1 A cavern containing an underground stream.

2 A later stage of the same showing a natural bridge.

3 A view of number "2" as seen from above.

To make such questions most stimulating and valuable, they should be used both in recitations and written tests. The absurd questions should be introduced among reasonable ones with no hint of their character, and they should not be overworked. Practical questions applying principles can not be too frequently used. One of the most important uses of the test diagram is to reveal to the teacher the state of the pupils' minds, and the revelation is often wonderful indeed.

Saturday afternoon, December 28

THE PURIFICATION OF WATER

(Abstract)

BY E. M. CHAMOT, CORNELL UNIVERSITY

The increasing complexity of modern life involving as it does the massing of population in certain districts and the wholesale distribution of water and food has served to intensify many difficulties in sanitation.

Nowhere is this more marked than in the question of water supply on account of the prevalence and nature of water-borne diseases. It has, in fact, become impossible to supply most municipalities with water from any natural source which is or may not become at any moment a source of danger from typhoid or other enteric disorders.

With this fact established it has been found necessary to resort to some process for the removal of bacteria or their destruction. Two general methods of filtration to accomplish this removal have come into use and are known as the slow or sand filtration and the mechanical or American method. The first of these requires large sand beds which are scraped periodically and on which there forms the so called pathogenic layer which is the active agent. The second method employs a coagulant which forms a glutinous mass and on settling carries the bacteria with it. After settling, the clearer portion is filtered through small sand beds, which may be washed by reverse flow.

There is no marked difference in efficiency in these two types of filter. When properly constructed and operated the removal of organisms is practically complete and the water is entirely safe.

Many illustrations of filter plants and their methods of operation were given and also statistics on the cost to the community of water-borne diseases and how water becomes polluted. It was made clear that water purification has become an economic question of prime importance as well as a sanitary one.

THE TEACHING OF SCIENCE

(Abstract)

BY L. H. BAILEY

It is first necessary to state what science is. It is fact, organized. It consists of indisputable knowledge and accepted rational hypothesis.

Organized fact underlies all effective living, and therefore all civilization that is worthy of the name. We have largely passed through the theological interpretation of the natural world; we have also passed through the philosophical interpretation of it; we are now in the epoch of the scientific interpretation, which is to ascertain the fundamental facts in respect to it and to reason only therefrom.

We are teachers; it is our business to open the minds of the young to the methods, the points of view, and the facts of science.

It is first of all essential that we distinguish between the teaching function and the research function. The research function is essential to the determination of the ultimate fact; but as teachers we are concerned primarily with the mode of presentation to the young minds. I propose to suggest four or five considerations that make for good teaching of science.

a Our minds must be open to the truth if we are to teach accurately and effectively. It is not the business of the teacher of science to prove a thesis, nor to assume gratuitously a point of view. In this respect the scientist differs from other men. It is a lawyer's business, for example, to advocate, or to prove a case and, therefore, to that extent he can not be a scientist. Neither are ministers scientists, for they start with an assumption of what truth is and then make their investigation fit the hypothesis. When ministers really become scientists, religion, as we now formulate it, will be upset but we shall arrive thereby at a truer statement of religion and a better outlook on life. Philosophers usually are not scientists because they start with an assumed premise. They are very likely to deceive themselves in the end. In the past they have too often been sophists. The scientist is interested in his fact and bases everything thereon; the philosopher and minister are likely to be interested more in the process of the argument or interpretation. The real scientist is absolutely impartial to himself and to his work. No matter what opinions he may have expressed, or what books he

may have written in support of any line of thought, he at once disregards his former position if he finds that facts are against it; and he is as intensely interested to discover these facts as any other person would be. Very few persons really desire to know the truth, and there are very few that are willing to believe it, even though they may be all unconscious of this mental attitude. So thoroughly are tradition, preconceptions and prejudices established in us that it is very difficult for any man so completely to dissociate himself that he can interpret the natural world without coloring his interpretation by his own personality. I suppose that we can never dissociate the interpretation of nature from personality; but the nearer the approach to this state the truer will be our outlook toward fact.

All these statements are well illustrated in the general movement of thought consequent on the publication of Darwin's books. Before his time the theological explanation of the world was dominant: animals and plants are what they are and where they are because so made and placed by the Creator. The adaptation of these organisms to their conditions is perfect because they were designed to be perfect. Darwin's philosophy challenged all this. The interpretation of nature following the publication of Darwin's early works, however, had just as strong teleological trend as before, for all the characteristics and organs of plants and animals were supposed to have been perfectly adapted to their conditions through long struggle for existence and survival of the fittest. It, therefore, became a habit of mind to ask what everything is for. Does a leaf have hairs, we assume that the hairs must have some definite purpose, even though they have arisen as the result of natural selection. Does the cactus have spines, they must be for the purpose of protecting the plant from browsing animals. Does an animal have curious markings, they must serve some purpose in its protection. The interpretation of nature was still definite. We have now learned, however, that we must not approach objects in nature with any assumption that everything serves a purpose. A few days ago a teacher wrote me asking what is the use of the peg on the germinating squash plant. I replied that I was not aware that it had any use; I am afraid that she was shocked when she got my letter. The proper attitude is not to ask what a thing is for, but to ask what it is.

b As science teachers we must put the learner into touch with life and activity. I am sure that we have been too much inclined

to separate our teaching from the affairs of life. It has been a popular demand that education be "practical," but educators seem to have resisted the demand to a large extent. I think that we would be in danger of giving the student a partial view of science and of life if all our teaching were to be practical in the sense of being usable in securing dollars and cents, but it certainly must be true that the practical affairs of life are as well worth incorporating into a body of knowledge and method of training as any other affairs or facts are. It is equally partial to teach only those things which do not have relation to the affairs of life, which unfortunately has been common. I like to use the word "adaptable" or "applicable" in the place of "practical."

I do not at all like the division of subject-matter into pure science and other science for I do not like the implication that some science is impure. All science is science whether it has any direct or obvious application or not and it is all equally worth teaching; but when we are dealing with the young it should be our opportunity so to instruct and lead out as to put the pupil into direct and sympathetic relations with the life he is living. I know a junior in college, for example, who has had college physics; he knows practically nothing about light, or heat, or sound, or friction, or the common physical phenomena of life, although he has had much mathematics. I am quite sure that some of us really learned more of understandable and relevant physics from Wells's old *Natural Philosophy* than some persons now learn from a course in physics. In the old days we taught botany to a large extent by requiring the pupils to collect plants and to press them neatly between layers of paper. We have passed that epoch and we do not wish to return to it; and yet that method with all its shortcomings had the advantage of taking the pupil out of doors and putting him in touch with real plants. Then came the German laboratory method and the study of minute structure and training in technic. We gained much in dexterity and we got nearer the fundamental facts but we lost our touch with life. It is not true that it is best to begin the teaching of plants by discussion of the cell and the lower forms of flowerless plants and all that. The first course in botany should put the pupil into rational relationship with the plants about him in their larger and grosser phases. We have passed through a similar phase in the teaching of zoology and we are now in the epoch of teaching physiology formally and sometimes even partially. It is significant that there is now a demand for the teaching of biology whereby we are to

get hold of the underlying processes of life whether in the plant, the animal or the human being, and we shall learn what are the reactions of all these organisms to their conditions and environments. This teaching will be what we ought to mean by the word practical.

c It is apparent that we are in the beginning of a widespread dissatisfaction with the textbook. This in fact amounts in some places to a revolt. This is one expression of the conviction that teaching should begin with the natural activities of the child and that books should be a secondary and incidental consideration. Every practical teacher, of course, recognizes that the textbook must be used, but we are beginning to feel that it is not a primary agent. The dissatisfaction is not so much with the textbook itself as with the character of the books. They have been developed very largely from the college or academic point of view and have been written too often by men engaged in college teaching. The colleges have imposed their methods on the schools. This method is usually too advanced in point of view for the public schools. It usually attempts to work out a body of knowledge rather than to put the pupil directly into relationship with the activities of life. The schools should now be strong enough to develop their own methods and their points of view even if in the end they thereby dominate the colleges.

The mere textbook teaching is nearly always poor teaching. Likewise the mere indoor laboratory teaching may be just as bad as exclusive textbook work. We have heard much about the poor teaching in the public schools. Speaking with public school teachers in mind, I bid them be comforted. Some of the poorest teaching I have ever seen has been in the colleges and universities. In the qualifications of the college teacher, the emphasis is likely to be placed in his knowledge and learning. Now, any one of good mind may become learned, but only a few persons can teach. Only a young mind can ever teach, whatever the age of the teacher. In colleges the teaching function is likely to be subjugated to the research function or the specialist function; and the mass of students is sacrificed to the few. Freshmen and the general classes are far the most important, not the special students here and there. The special advanced students usually have interest and momentum enough to enable them to make their own way with the minimum of effort on the part of the teacher. Many a teacher in the secondary schools will give the pupils a better grasp on the subject and a

broader point of view than a learned college professor, and for the very good reason that such teacher is not so conscious of his scientific reputation as to be afraid to teach. He is blest with what some good persons call a "superficial" view of the subject. A good teacher in the secondary schools is able to get along with not very much expensive laboratory equipment. I am convinced that some of our equipment is too expensive and too complete for the best teaching, however necessary it may be for research. Some high schools have emulated the equipment of colleges until they have more apparatus than they need, and when this occurs it becomes a positive handicap. Both in colleges and secondary schools we need to get back to directness and simplicity. Our first aim should be to develop experience and to give a point of view.

We are likely to place too great value on the mere subject-matter of any course of study. In colleges we must come to a time when students do not choose subjects merely by their names in the catalogues. Sometime we will make our courses of study in terms of the men who teach. I am sure that our colleges are turning out a vast number of uneducated persons.

d There is a rapidly rising interest in the teaching of agriculture and other industrial subjects. This, I take it, is only another expression of the feeling that our education must be made vital and applicable. I am looking to the teaching of agricultural subjects in both colleges and public schools as a means of introducing a new type of educational effort. We shall probably find when we come to write a history of education a few years hence, that the agricultural colleges have made a very great contribution to constructive pedagogy. We shall find also that their influence will have had marked effect on the type and mode of teaching in all public schools everywhere. It is not so much that the subject is agriculture as it is that the teaching is directly related to the normal development of the pupil or the student.

e There is a widespread and growing interest in the nature study spirit. We are gradually coming to realize that nature study is not a subject to be added to a curriculum so much as it is a mode of teaching. Neither is it a "method," as that term is understood in normal schools and elsewhere. The nature study mode is to teach the things nearest at hand and to teach them for the sake of the pupil rather than for the sake of the subject. It takes a pupil out of doors and into touch with the natural world of men and animals and plants and to the earth on which we live.

It has been said that the nature study movement applies specially to the secondary schools. I have come to feel that there is just as much need of it in the colleges as in the public schools for the work of colleges also may be barren.

f My thesis then is this: as science teachers we should be interested more in the student than in the science; the student needs point of view and conception; the science teaching should be vital, relevant, meaningful and applicable.

MEMBERS 1908

Where no state abbreviation is given, New York is to be understood.

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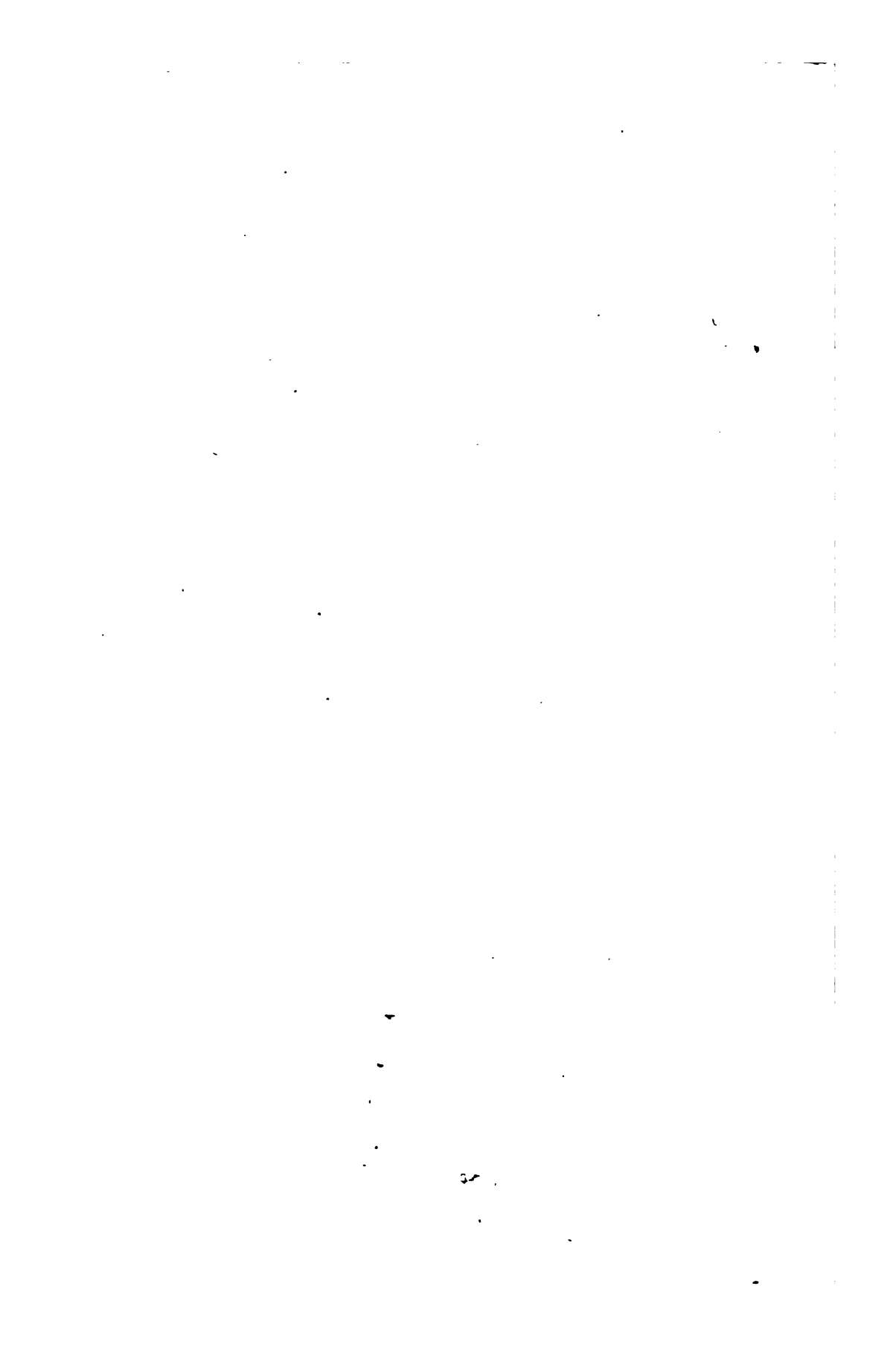
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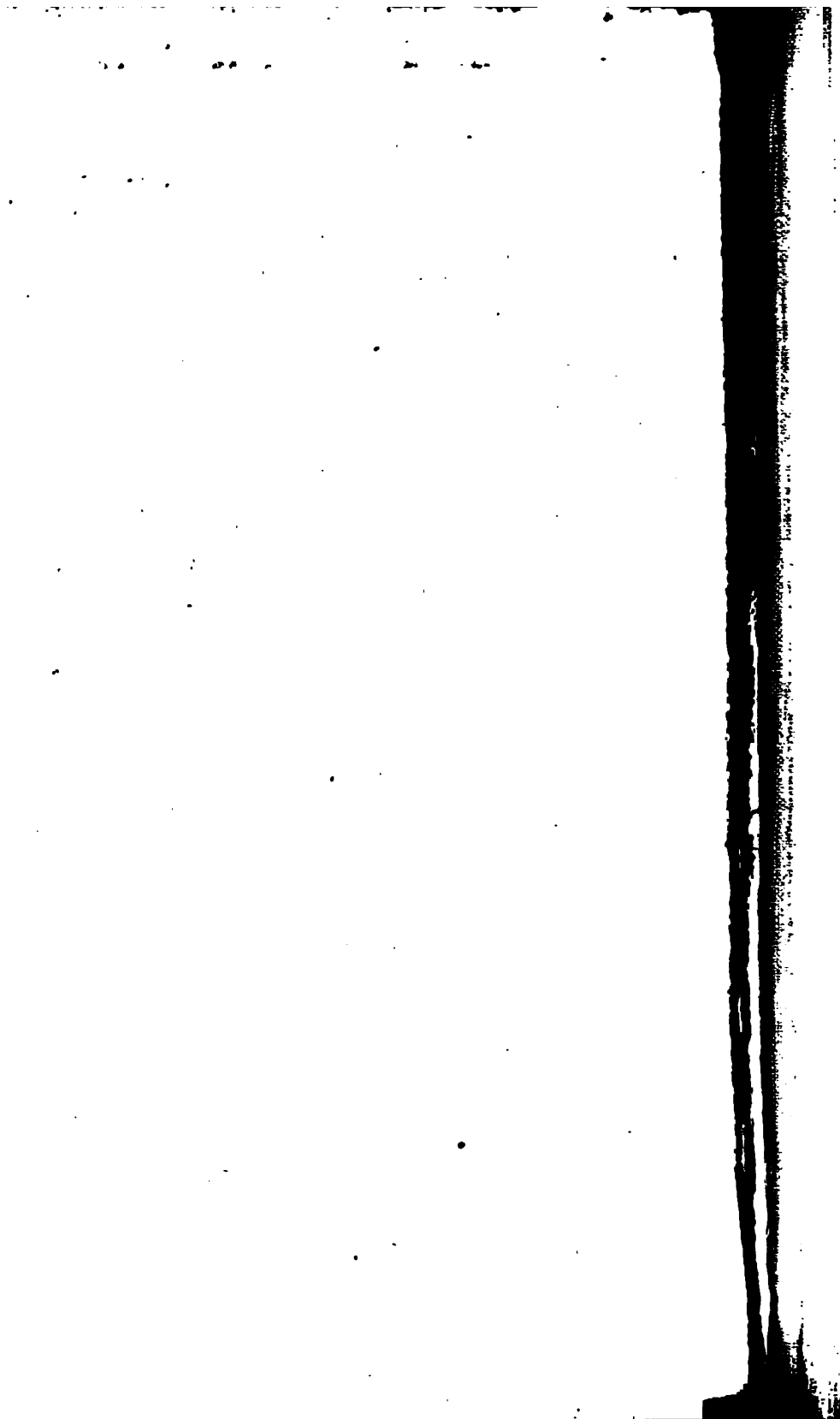
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